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WHAT NEED IS THERE FOR CORRECTIVE ARITHMETIC, AND WHAT PROGRESS IS IT POSSIBLE TO ACHIEVE IN A LIMITED TIME?

Submitted by:

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Last, but no less sincerely, the writer acknowledges with deep gratitude the whole-hearted cooperation of the four cooperating teachers, whose unfailing willingness to do all that was asked of them proved such a source of encouragement to the writer, and without whose help it would have been impossible to make a study of this kind.

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TABLE OF CONTENTS.

CHAPTER I. INTRODUCTION.

CHAPTER II. METHOD OF PROCEDURE FOR DETERMINING THE CORRECTIVE LOAD.

CHAPTER III. ACQUAINTING COOPERATING TEACHERS WITH RESULTS OF INITIAL TEST.

CHAPTER IV. WORK DONE IN EXPERIMENTAL GROUP.

CHAPTER V. RESULTS OF THE RE-TEST IN MARCH.

CHAPTER VI. COMPARISON OF RESULTS OF THE INITIAL AND RE-TEST.

CHAPTER VII. SUMMARY AND CONCLUSION.

LIST OF TABLES.

TABLES I. TO V. INDIVIDUAL RECORDS BY ROOMS SHOWING RESULTS ON EACH OF THE FOUR PROCESS TESTS ON INITIAL TEST IN OCT.

TABLES VI. TO X. TWO-WAY DISTRIBUTION SHOWING SCORE AND TIME BY ROOMS ON INITIAL A. P. TEST.

TABLE XI. SUMMARY TABLE FOR INITIAL A, P. TEST.

TABLES XII. TO XVI. TWO-WAY DISTRIBUTION SHOWING SCORE AND TIME BY ROOMS ON INITIAL S. P. TEST.

TABLE XVII. SUMMARY TABLE FOR INITIAL S. P. TEST.

TABLES XVIII. TO XXII. TWO-WAY DISTRIBUTION SHOWING SCORE AND TIME BY ROOMS ON THE INITIAL M. P. TEST.

TABLE XXIII. SUMMARY TABLE FOR INITIAL M. P. TEST.

TABLES XXIV. TO XXVIII. TWO-WAY DISTRIBUTION SHOWING SCORE AND TIME BY ROOMS ON THE INITIAL L. D. P. TEST.

TABLE XXIX. SUMMARY TABLE FOR THE INITIAL L. D. P. TEST.

TABLE XXX. CORRECTIVE LOAD IN OCT. IN FOUR FUNDAMENTAL PRO - CESSES.

TABLES XXXI. TO XXXV. INDIVIDUAL RECORDS BY ROOMS SHOWING RESULTS ON EACH OF THE FOUR PROCESS TESTS ON RE-TEST IN MARCH.

TABLES XXXVI. TO XL. TWO-WAY DISTRIBUTION SHOWING SCORE AND TIME BY ROOMS ON A. P. RE-TEST.

TABLE XLI. SUMMARY TABLE FOR THE A. P. RE-TEST.

TABLES XLII. TO XLVI. TWO-WAY DISTRIBUTION SHOWING SCORE

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LIST OF TABLES (CONT.).

TABLES XLII. TO XLVI. (CONT.) AND TIME BY ROOMS ON S. P. RE-TEST.

TABLE XLVII. SUMMARY TABLE FOR THE S. P. RE-TEST.

TABLES XLVIII. TO LII. TWO-WAY DISTRIBUTION SHOWING SCORE AND TIME BY ROOMS ON M. P. RE-TEST.

TABLE LIII. SUMMARY TABLE FOR THE M. P. RE-TEST.

TABLES LIV. TO LVIII. TWO-WAY DISTRIBUTION SHOWING SCORE AND TIME BY ROOMS ON L. D. P. RE-TEST.

TABLE LIX. SUMMARY TABLE FOR THE L. D. P. RE-TEST.

TABLE LX. COMPARISON OF PERFECT SCORES OBTAINED ON INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.

TABLE LXI. COMPARISON IN THE NUMBER OF PUPILS HAVING 100% SCORES IN ONE OR MORE PROCESSES BY ROOMS ON INITIAL AND RE-TEST, FOUR PERFECT SCORES BEING POSSIBLE.

TABLE LXII. IMPROVEMENT IN MEAN SCORES EXPRESSED IN PERCENT FOR ALL ROOMS IN EACH PROCESS FROM INITIAL AND RE-TEST.

TABLE LXIII. DECREASE IN MEAN TIME EXPRESSED IN MINUTES FOR ALL ROOMS IN EACH PROCESS ON INITIAL AND RE-TEST.

TABLE LXIV. COMPARISON OF IMPROVEMENT IN MEAN SCORES AND DECREASE IN MEAN TIME ON INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.

TABLE LXV. COMPARISON OF GAIN IN MEAN SCORES AND DECREASE IN MEAN TIME EXISTING BETWEEN INITIAL AND RE-TEST BY ROOMS

LIST OF TABLES (CONT.).

TABLE LXV. (CONT.) FOR EACH PROCESS.

TABLE LXVI. RESULTS OF EXPERIMENTAL GROUP IN INITIAL AND RE-TEST, INCLUDING MEAN SCORES AND MEAN TIME, AND THE NUMBER OF PUPILS UP TO BOTH STANDARDS.

TABLES LXVII. TO LXX. COMPARISON OF SCORES OBTAINED BY ALL ROOMS ON INITIAL AND RE-TEST FOR EACH PROCESS SEPARATELY.

TABLE LXXI. SUMMARY TABLE SHOWING PERCENT OF PUPILS MAKING UP THE CORRECTIVE LOAD ON INITIAL AND RE-TEST, AND PERCENT OF OF PUPILS BEING EXCUSED IN EACH PROCESS, INCLUDING THE PERCENT GAIN FOR EACH PROCESS.

TABLE LXXII. COMPARISON OF NUMBER OF PUPILS EXCUSED FROM CORRECTIVE WORK IN FOUR FUNDAMENTAL PROCESSES BY ROOMS ON INITIAL AND RE-TEST.

TABLE LXXIII. COMPARISON IN NUMBER OF PUPILS UP TO BOTH ACCURACY AND TIME STANDARDS ON INITIAL AND RE-TEST.

TABLE LXXIV. GRAND SUMMARY TABLE FOR BOTH INITIAL AND RE-TEST, SHOWING SUMMARY OF ALL DATA IN THIS STUDY.

LIST OF EXHIBITS.

EXHIBIT 1.	INSTRUCTIONS FOR GIVING THE WILSON TESTS IN OCTOBER.
EXHIBIT 2.	ANALYSIS OF A. P. TEST.
EXHIBIT 2. (CONT.)	FREQUENCY OF ERRORS ON A. P. TEST.
EXHIBIT 3.	WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN ADDITION.
EXHIBIT 4.	ANALYSIS OF S. P. TEST.
EXHIBIT 4. (CONT.)	FREQUENCY OF ERRORS ON S. P. TEST.
EXHIBIT 5.	WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN SUBTRACTION.
EXHIBIT 6.	ANALYSIS OF M. P. TEST.
EXHIBIT 6. (CONT.)	FREQUENCY OF ERRORS ON M. P. TEST.
EXHIBIT 7.	WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN MULTIPLICATION.
EXHIBIT 8.	WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN LONG DIVISION.
EXHIBIT 9.	SAMPLE PAGE FROM NOTE BOOK.
EXHIBIT 10.	MY ADDITION GRAPH.
EXHIBIT 11.	DIAGNOSIS OF MULTIPLICATION ERRORS FOR ROOM R.
EXHIBIT 12.	MY ARITHMETIC GRAPH. (MULTIPLICATION)

LIST OF EXHIBITS (CONT.).

EXHIBIT 13. MY ARITHMETIC GRAPH. (LONG DIVISION.)

EXHIBIT 14. CLASS RECORD OF PERFECT SCORES IN DIVISION BY SEX FOR COMPETITIVE PURPOSES ONLY.

EXHIBIT 15. DIRECTIONS FOR RE-TESTING IN THE FUNDAMENTALS OF ARITHMETIC.

LIST OF CHARTS.

CHART I. CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL A. P. TEST IN OCTOBER.

CHART II. CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL S. P. TEST IN OCTOBER.

CHART III. CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL M. P. TEST IN OCTOBER.

CHART IV. CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL L. D. P. TEST IN OCTOBER.

LIST OF GRAPHS.

GRAPH 1. SHOWING NUMBER OF PUPILS FROM ALL ROOMS IN GRADE 6 OBTAINING PERFECT SCORES ON THE INITIAL TEST IN OCTOBER AND ON THE RE-TEST IN MARCH, FOR EACH PROCESS.

GRAPH 2. SHOWING NUMBEROF PUPILS FROM ALL ROOMS IN GRADE 6 OBTAINING PERFECT SCORES ON THE INITIAL TEST IN OCTOBER AND ON THE RE-TEST IN MARCH FOR ADDITION.

GRAPH 3. SHOWING NUMBER OF PUPILS FROM ALL ROOMS IN GRADE 6 OBTAINING PERFECT SCORES ON THE INITIAL TEST IN OCTOBER AND ON THE RE-TEST IN MARCH FOR SUBTRACTION.

GRAPH 4. SHOWING NUMBER OF PUPILS FROM ALL ROOMS IN GRADE 6 OBTAINING PERFECT SCORES ON THE INITIAL TEST IN OCTOBER AND ON THE RE-TEST IN MARCH FOR MULTIPLICATION.

GRAPH 5. SHOWING NUMBER OF PUPILS FROM ALL ROOMS IN GRADE 6 OBTAINING PERFECT SCORES ON THE INITIAL TEST IN OCTOBER AND ON THE RE-TEST IN MARCH FOR LONG DIVISION.

WHAT NEED IS THERE FOR CORRECTIVE ARITHMETIC, AND WHAT PROGRESS IS IT POSSIBLE TO ACHIEVE IN A LIMITED TIME?

CHAPTER I. INTRODUCTION.

1. IMPORTANCE OF ARITHMETIC IN THE CURRICULUM.
2. NEED FOR CORRECTIVE ARITHMETIC.
3. CAUSES OF FAILURES IN ARITHMETIC.
4. CHARACTERISTICS OF GOOD DRILL PROCEDURE.
5. STUDIES MADE IN THE FIELD OF CORRECTIVE ARITHMETIC.
6. PLACE OF THIS STUDY.
7. PLAN OF THIS STUDY.

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CHAPTER I. INTRODUCTION

1. IMPORTANCE OF ARITHMETIC IN THE CURRICULUM.

Education at one time consisted chiefly of teaching the rudiments of the tool subjects, reading, writing, arithmetic, and spelling. Enrichment of the curriculum has continued apace but the tools have not been neglected. On a comparative basis they are better taught than ever before. Arithmetic is one of the major studies of the school curriculum, and as such it occupies a prominent place. In most schools much time is spent in every grade on various phases of arithmetic, and it is natural to suppose that the pupils acquire a fund of knowledge in this field which should be useful to them in later life. However, it is appropriate to study the results of instruction.

2. NEED FOR CORRECTIVE ARITHMETIC.

Buswell says that "failures in the elementary school are caused more frequently by arithmetic than by any other subject in the curriculum"(1) Brownell has shown that "our business men from all departments are complaining that their employees are unable to perform with accuracy even the simplest of arithmetical processes."(2)

(1) Buswell, G. T. and John, Lenore, Diagnostic Studies in Arithmetic. University of Chicago Press, July 1926. p. 1.

(2) Brownell, W. A., The Development of Children's Number Ideas in the Primary Grades. University of Chicago Press, 1928. p. 3.

Edwards, in his study shows that there is a lack of mastery of fundamentals on the part of elementary school graduates.(1)

It is the experience of every teacher to have in her class a percentage of pupils who have not learned the work of the preceding grade or grades, who do not know the primary number facts accurately, and who are in a state of confusion on many phases of arithmetic. If facts and processes are not learned when first presented, or if they are learned incorrectly, or are not understood, then it is necessary to teach and re-teach until facts are completely mastered and process steps are clearly understood, and until there are no confusions existing in the minds of the pupils. Many studies made in the field show that there is a great and definite need for corrective arithmetic.

3. CAUSES OF FAILURES IN ARITHMETIC.

Because more failures occur in arithmetic than in any other school subject, it would be wise to probe a little deeper and try to determine the causes of failure in arithmetic. Sangren, in his study states "a significant cause of errors was insufficient knowledge of number facts."(2) These number facts are the foundations of all work in arithmetic and until they are known accurately and automatically, progress is not possible.

(1) Edwards, W. H. "Bridging the Gap between Theory and Practice in Ninth-Grade Mathematics." School Science and Mathematics. 28: November 1928. p 846-866.

(2) Sangren, Paul B. "The Woody-McCall Mixed Fundamentals Test and Arithmetic Diagnosis", Elementary School Journal. 24:205-215, November 1934.

Yarbrough in her study lists the following as causes of failure:

1. Physical defects.
2. Systematic drill is started too soon.
3. The teacher often has no systematic plan for teaching the fundamental processes.
4. Children are pushed ahead too rapidly.
5. Drill is carried on ineffectively.
6. Drill load is too heavy.
7. Teachers are failing to recognize, diagnose and correct errors found in the work of their pupils as soon as they appear.(1)

Another cause for failure is the inclusion in the subject matter of much material for which the child will have no use in life later on. Educators have been advocating the application of the social usage criterium to the field of arithmetic. In the light of investigations made such topics as "greatest common denominator, troy weight, apothecaries' weight, foreign exchange, surveyor's measure, and denominate numbers"(2) would be eliminated from the curriculum entirely as drill material.

(1) Yarbrough, Dorothy. "A Diagnosis of Pupils' Errors in Arithmetic with a View to Corrective Work Carried on through the Cooperation of the Teachers." Master's Thesis B. U. School of Education. 1938. p. 108-9.

(2) Wilson, Guy M."What Arithmetic Shall We Teach?" Houghton Mifflin Company, Boston 1926. p. 126.

In a recent article we read "If the arithmetic program were placed on a functional basis, the needed arithmetic could be done easily, and successfully on a 100% basis in much less time than is given to the arithmetic we now teach.(1) These findings are now widely supported by other studies.(2)

Thus we see that an overcrowded curriculum is another cause for errors in arithmetic. The many topics included in this field should be examined very thoughtfully. They should be re-classified into two types. These types might well be (a) the material which is to be used for informational purposes and will be needed for future reference: and (b) that material which is essentially fundamental and needs to be definitely learned. Two types of teaching would be involved in this classification, the appreciation method and the drill method. If this were done, time could be apportioned intelligently, and emphasis could be placed where it is most needed. As it is now, emphasis has been misplaced and as a result a condition such as Courtis found in 1916 still exists in many schools today.(3)

(1) Wilson, Guy M., "Paying for Useless Arithmetic." Education 55:430 March 1935.

(2) Wise, Carl T., "A Survey of Arithmetical Problems Arising in Various Occupations." Elementary School Journal XX:118-136 October 1919.
Woody, Clifford., "Types of Arithmetic Needed in Certain Types of Salesmanship." Elementary School Journal XXII:505-20 March 1922.

(3) Wilson, Guy M., "Arithmetic and the Taxpayer." National Educational Association Journal. 20:221 June 1931.

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(1) Wilson, Guy M., "Testing for Useless Arithmetic." Education 58:430 March 1938.

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Woody, Clifford., "Types of Arithmetic Needed in Certain Types of Businesses." Elementary School Journal XXII:513-20 March 1922.

(3) Wilson, Guy M., "Arithmetic and the Taxpayer." National Education Association Journal. 20:221 June 1931.

"Until the non-essentials are removed from the arithmetic offerred in all the grades, and the time is given over to the mastery of the arithmetic commonly used in life, these percentages will remain" is a conclusion reached by Randall.(1)

Still another cause of errors in arithmetic is the fact that some teachers do not find out how the child works. Buswell in his Diagnostic Studies in Arithmetic says, "In arithmetic effective teaching can hardly be expected until the teacher understands in detail the methods which the pupils employ in doing their work."(2) This often means it is necessary for the teacher to listen as the child works out the example orally so she can discover what is done that produces the error.

Hanley in her study gave these facts as causes for failures:

1. "Overcrowded curriculum. We expect the children to learn more than they will ever use." She suggests that the program be simplified so that success may be a legitimate attainment of all pupils.

2. "The initial teaching is begun too soon." Formal work in arithmetic should be delayed until grade 3 was the recommendation made by the National Committee in 1925.(3)

3. "Lack of systematic procedure on the teacher's part is a very large factor in the cause of failures."

(1) Randall, Joseph H., "Corrective Arithmetic in the Junior High School." Master's Thesis Boston University 1936.p 5.

(2) Op. Cit. p. 7.

(3) FOURTH YEAR BOOK DEPT. OF SUPERINTENDENCE NATIONAL EDUCATIONAL ASSOCIATION 1925. pg. 175

4. "The practice of accepting passable marks instead of maintaining a high standard of achievement is another great cause of errors."(1)

Yet another cause for failure in arithmetic is poor teaching on the part of some teachers. Buswell further states: "What the school should insist on is that the teacher should teach more, that the teacher should teach more intelligently, more purposefully, and more specifically."(2) The teachers are not entirely to blame for this situation. Pressure from above --supervisors and standard city-wide tests-- are big factors causing teachers to include too much and to hurry too fast. This is done so that their classes may make a good showing and so that the ground may be covered as specified in the Course of Study. Teachers will have to be educated to the point that the Course of Study is merely suggestive and tentative, and overcome the idea that everything in the Course of Study must be taught as a hard and fast requirement on a drill basis.

Teachers will also have to be educated to accept the viewpoint that in order to teach at all, it is necessary to begin where the child is and go on from there. It is every teacher's job to find out how much the child knows, even if it

(1) Hanley, Gertrude L. "Corrective Load in the Fundamentals of Arithmetic in Grades 4, 5, and 6." Master's Thesis Boston University, School of Education 1938.

(2) Op. Cit. p. 199.

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(1) Hanlay, Gertrude L. "Corrective Load in the Fundamentals of Arithmetic in Grades 4, 5, and 6." Master's Thesis Boston University, School of Education 1938.

(2) Op. cit. p. 189.

means that he is backward several grades in a subject, and start from there to teach him. This means teaching facts that are not included in the present grade. It means individual work, and this involves a greater amount of preparation, but it brings proportionate results. In such a subject as arithmetic, if the foundation is lacking, how can advanced work be expected to be learned, or understood! Fundamentals are essential and there is no substitute for them. If individual instruction is to take the place of class instruction as much as possible in the corrective field, teachers must learn how to do individual and small-group work in large classes.

To summarize briefly then, some of the causes of failures in arithmetic are:

1. Initial teaching is begun too soon.
2. Arithmetic is not organized on a discriminating basis. Teachers must learn that drill is not appropriate for many topics.
3. Undertaking too much drill causes haste and inefficiency.
4. Teachers often have no systematic plan for teaching the fundamental processes, thus making the work ineffective.
5. The drill load is not lightened by proper distribution.
6. Low standards of achievement are acceptable thus allowing errors to persist instead of eradicating them immediately.
7. Pupils' work is not thoroughly diagnosed intelligently so that errors are known immediately.
8. Fundamental facts and process steps are not sufficiently well learned.

9. Lack of knowledge on the teacher's part of how the child works, hinders his progress.

10. Poor teaching on the part of some teachers tends to establish errors rather than eliminate them.

4. CHARACTERISTICS OF GOOD DRILL PROCEDURE.

Since a Corrective Arithmetic Program is necessarily one that involves the accurate learning of a large body of facts which must be reproduced accurately and automatically in many situations, the method for teaching these facts is chiefly the DRILL METHOD. Since in this study the aim is to establish 100% accuracy as the standard of achievement for each pupil, it is essential that a few words be said about the characteristics of good drill procedure.

Wilson in his Teachers' Manual on 100% Arithmetic (1) strongly recommends systematic drill. He further states that all good conditions of drill should be observed, and lists the following:

(1) Drill must be kept behind meaning at all times.

(2) Drill must be thoroughly motivated.

(3) Drill should be deferred until the need is evident to the child and he really wants to do it.

(4) The laws of memory must be observed.

(5) All other conditions of a correct drill procedure must be met.

(1) Wilson, Guy M., Teachers' Manual on 100% Arithmetic The Mac Millan Co., New York 1933. p. 34.

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(1) Wilson, Guy M., Teachers' Manual on 100% Arithmetic The Mac Millan Co., New York 1925. p. 34.

Newcomb[1] lists the following as the essentials of effective drill; variety, provision for daily practice, live up-to-date problems, short periods of practice, use of a time limit, and definite objectives.

Klapper[2] maintains that motivation, adequate comprehension, repetition, focused attention and conditions introduced to sustain attention are the essentials of effective drill.

Osburn[3] urges that the drill material be so arranged that each element should be practiced when it is most needed. He states that short periods are best, that there should be complete rationalization before drill, that individual help should be given on points of difficulty, that there should be self-activity on the pupils' part, that drill should be systematic and that practice plus concentrated attention should bring the desired results.

Charters[4] says that "material drilled upon must be of sufficient importance to justify its being learned; that material must be simple enough to warrant perfect mastery of it; that response must be identical each time; that success

(1) Newcomb, Ralph S. Modern Methods of Teaching Arithmetic. Houghton Mifflin Co. Boston 1926. p. 72.

(2) Klapper, Paul, The Teaching of Arithmetic. D. Appelton-Century Co. New York 1934. Chapter 8.

(3) Osburn, Worth J., Corrective Arithmetic. Houghton Mifflin Co. Boston 1924. p. 61.

(4) Charters, W. W., Methods of Teaching. Row-Peterson Co.

must be the chief reliance for motivation in drill; and that the child must understand what he is being drilled upon."

In the light of these observations, it can be readily seen that the correct drill procedure means something very definite. It must be well planned, and include every child that needs the particular thing which is to be drilled upon. If a child has attained a perfect score in a process, it is not necessary for him to continue to drill further upon it. He should be excused from further drill on that subject, and spend the time on some other phase that he does need drill on. He can also be very successfully employed as a leader of a small group who are drilling on what he already is proficient in.

The question of motivating the drill lesson is a very important one. Interest may be maintained by using a variety of drills, by fixing a time limit, by introducing competition between pupils and among groups, and by using games and contests. Variety may be introduced by changing the objects, materials, and activities; by changing the sense appeal; and by changing the combinations to be studied. The highest form of motivation is the desire to beat one's own record of the previous day. When this desire can be aroused in a child, when he realizes that he can do better, and can succeed in his work, then drudgery will turn into pleasure, and happiness will be an accompaniment of learning.

To summarize, drill to be effective must be systematic, well-planned, individual in its scope, thoroughly motivated,

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To summarize, drill to be effective must be systematically planned, individual in its scope, thoroughly motivated,

given in acceptable periods frequently, and be possible of achievement by all.

5. STUDIES MADE IN THE FIELD OF CORRECTIVE ARITHMETIC.

There have been a number of studies made in this field by various students working for the Masters Degree at Boston University. The first writers began with individuals, and made their investigation and diagnosis apply to individuals. In 1935 Marion Bowdren wrote on "Five Cases of Arithmetic Failures."(1) She used the following method:

1. Conference with parents.
2. Inventory Tests.
3. Diagnostic Tests.
4. Personal contacts with the child outside of school.
5. Remedial work and systematic drill.

She included the school history, the character of the child, and the causes for failure in her investigation. Then she told the procedure used with each child and gave the plan of the type of remedial work used with each pupil. This naturally varied with each pupil. She worked with the four fundamental processes. She was able to bring each child to the place where he overcame his dislike for arithmetic and brought the grade work up to a satisfactory basis for success. She concludes that "since the four fundamentals make up over 90% of

(1) Bowdren, Marion, "Five Cases of Arithmetic Failures." Master's Thesis, Boston University, School of Education, 1935.

the adult usage of arithmetic, they should be taught perfectly." She feels that the work in the school should be adjusted to the pupil and that each pupil should succeed.

Edward Soles[1] worked with twenty-three pupils in addition. He showed how he used diagnosis to help determine the errors each pupil made, and then gave specific examples of how he helped them to correct their errors. The aim of his study was three-fold:

1. To help children who are in a state of confusion in arithmetic.

2. To give teachers a scheme of diagnosis and corrective measures.

3. To train better arithmetic teachers through giving them an understanding of the difficulties which pupils meet in addition.

He concludes that success in corrective work will depend on (a) keeping careful records so that progress may be measured, (b) planning units of work small enough to coincide with the abilities of the pupils, (c) reviewing in order to keep all facts learned, (d) motivating to stimulate the will to work and (e) assuring success by lightening the burden to match the maturity of the learner.

Roman Pucko[2] worked with five individuals in the

(1) Soles, Edward A., "Diagnostic and Corrective Measures in Addition." Master's Thesis, Boston University, School of Education, 1935. p. 93

(2) Pucko, Roman, "Five Case Studies of Arithmetic Failures." Master's Thesis, Boston University, School of Education, 1935.

four fundamental processes. He gave a detailed analysis of each pupil, covering his school history, his personality, his home conditions, the results attained in tests in arithmetic, a detailed analysis of difficulties with illustrations, and a general plan of the remedial instruction given. He showed that even with short periods of instruction it was possible for pupils to make progress when they understood what they were doing.

A year later Joseph Randall (1) showed how corrective work in arithmetic could be carried on effectively at the Junior High School level. He worked with eight pupils from grade 8 who had I. Q's above 100 and limited the work to addition and subtraction. These pupils voluntarily spent the time outside of school hours to improve themselves. He showed that it is possible with pupils of higher than average intelligence to correct faults in factual knowledge and process skills with a reasonable expenditure of time and properly motivated remedial work. He also felt that remedial work should be included as an elective in the Junior High School curriculum.

The next type of investigation in this field was of a broader scope. The basis of the group selected was the class as a whole. A different type of procedure was necessary when the number of pupils to be helped was increased.

Yarbrough (2) worked out a plan whereby corrective work could be carried on by several teachers in the same grade

(1) Op. Cit.
(2) Op. Cit.

in one building effectively. She worked with four teachers, handling one hundred twenty-seven (127) pupils at the sixth grade level. She included work in addition, subtraction and multiplication. When she had determined the corrective load through tests, she made individual diagnoses of errors. Then drill work was carried on. Then re-tests were made. She showed how it was possible with a group of teachers cooperating to achieve satisfactory results. At the beginning of her study only three pupils out of the one hundred twenty-seven were excused from drill, whereas at the end fifty-five of them could be excused.

Hanley[1] worked out her problem in a whole town system in the grammar grades (4-5-6), covering six schools, thirty-four teachers and one thousand one hundred twenty-four (1124) pupils. She determined the corrective load in arithmetic in these grades. Hers was entirely a cooperative experiment really teaching the regular teachers an effective method to use, encouraging them, and tabulating and interpreting the results of tests so that they could be of use in the school room to the classroom teacher. It is interesting to note that of the 1124 pupils tested, if perfect scores of 100% were required, just two pupils would have been excused from further drill. Even reducing the standard to 92% only 19 pupils would have been excused from drill. This is keeping the time factor at just a "reasonable time".

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The conclusion that she reached from her study, after finding out the tremendous corrective load of this town, was that a revised program was necessary. She recommended the following procedure:

1. Smaller amount of facts for perfect mastery.

2. Systematic, well-planned drill.

3. Motivated lessons. This involves the education of the teachers and the overcoming of tradition. The chief value of her study lay in the fact that an adequate situation was provided in which the teachers could discover for themselves the "deficiencies of the traditional scheme of teaching arithmetic," which provided them with the proper incentive for improving their teaching.

Nelson (1) tested one thousand two hundred fifteen (1215) pupils in a large city Junior High School in all the fundamental processes in the 7th, 8th and 9th grades. She found that the corrective load at this level was exceedingly high. Holding 100% as the standard, 88% of the pupils were deficient in addition, 85% were deficient in subtraction, 97% were deficient in multiplication and 94% were deficient in long division. She recommends that all corrective work be kept on an individual basis, that small units of work be prepared, and that a well-planned drill technique be used.

Thus the investigation has progressed from the study

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(1) Nelson, Helen G. "Corrective Load in Arithmetic in a Junior High School" Master's Thesis, Boston University School of Education 1928.

of individuals, outlining the effective procedure used with each one, to single classes adapting the procedure to a group, then to groups of classes of the same grade in one school, and finally enlarging the group to include an entire school itself.

A few studies in corrective arithmetic have been reported from other sections of the country, particularly Peabody College for Teachers and Chicago University.

6. PLACE OF THIS STUDY IN THE FIELD.

The present study shows another step in the investigation in the field. The scope is enlarged again from a single classroom to cover a large district in a metropolitan school system. It is the effort of a regular class-room teacher, who is also a part-time graduate student, working out a cooperative experiment with four other sixth grade teachers in her district, including two separate buildings. The number of pupils tested was one hundred eighty-seven (187). The field of the test included the four fundamental processes.

7. THE PLAN OF THIS STUDY.

The first thing which this study attempts to show is the need for Corrective Arithmetic in these five sixth grades. This is called "determining the corrective load". This was done by giving the WILSON INVENTORY AND DIAGNOSTIC TESTS IN ARITHMETIC[1] in the four fundamental processes, addition, subtraction, multiplication and division. These tests are arranged according to process step difficulties. They will be re-

(1) Wilson Inventory and Diagnostic Tests in Arithmetic, Spaulding Moss Co. 1936.

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ferred to in this study as the A. P. TEST,[1] the S. P. TEST,[2] the M. P. TEST,[3] and the L. D. P. TEST[4]. Late in October the tests were given simultaneously. One test was given each day by the classroom teacher. The writer did all the correction. Results were recorded, graphs were made and errors were noted. Each teacher then carried on the corrective work in her own way in her classroom, with suggestions and conferences from time to time. In the middle of March each class was retested and the results were compared. The same procedure was followed in both the initial test in October and the re-test in March.

COMPOSITION OF GROUP TESTED.

The pupils in grade six in this district are a representative group such as is found in any metropolitan school system. The range in I. Q's is as follows:

	-Room L	-Room W	-Room J	-Room H	-Room R	-Total
Inferior below 75	1	1	1	3	1	7
Below Average 75-90	5	12	4	10	7	38
Average 90-100	20	10	19	18	16	83
Above Average 110-125	11	8	10	6	11	46
Superior above 125	3	7	3	1	2	16
Totals	40	38	37	38	37	190

(1) A. P. (Addition Process) See Appendix for form.
(2) S. P. (Subtraction Process) See Appendix for form.
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Note: Several pupils were absent and were not included, so this total is 2 less than the total as shown in the chronological age grouping.

The median falls in the average group (90-110).

Just a word should be said about the make up of these classes. Room J is made up of the top half of two fifth grades. Rooms H and R are made up of the lower half of the two fifths and the top half of another fifth grade is divided between them, plus the lower quarter of the third fifth. Rooms L and W were small having 28 pupils at the time of the initial test. Later in the year (Jan.) they were re-organized and pupils from another sixth were added, making 40 in each. This necessitated regrouping the pupils and re-arranging the results in table form. Six pupils who had transferred in the interim were not included at all in the revised tabulation. All tables which follow in this study are according to the arrangement at the end of the period. This re-organization of classes undoubtedly had some effect on the final results.

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The pupils arranged in groups according to chronological ages are as follows:

Years	-Room L	-Room W	-Room J	-Room H	-Room R	-Total
9	2	2	3	2	2	11
10	23	19	14	16	17	89
11	10	10	16	12	9	57
12	3	7	4	7	5	26
13	2	0	1	1	4	8
14	0	0	0	1	0	1
Total	40	38	38	39	37	192

These figures show that the pupils range in age from 9 to 14 years, and in I. Q. from 62 to 140.

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CHAPTERII. METHOD OF PROCEDURE FOR DETERMINING THE CORRECTIVE LOAD.

1. GIVING THE TESTS.

   EXHIBIT 1. INSTRUCTION SHEET.

2. CORRECTION OF TESTS.
3. RECORDING RESULTS.
   (a) Individual records of pupils showing Age, I. Q., and score and time for each test in each process.
   (b) Two-Way Distributions showing Scores and Time for each test for each room.
   (c) Summary Tables for each process for all rooms.
4. DIAGNOSIS OF RESULTS OF ALL CLASSES TO DETERMINE THE CORRECTIVE LOAD.
5. SUMMARY: CORRECTIVE LOAD DETERMINED.

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CHAPTER II. METHOD OF PROCEDURE FOR DETERMINING THE CORRECTIVE LOAD.

The first step in the development of a Corrective Arithmetic Program is the determination of the DRILL LOAD. This was done by administering an Inventory and Diagnostic Test, by diagnosing the results, and by finding out the pupils who need help in certain definite situations.

Every sixth grade pupil was given the WILSON INVENTORY AND DIAGNOSTIC TESTS IN ARITHMETIC in the four fundamental processes. The results of these tests can be so analyzed as to show for each process any deficiencies in the mastery of facts, or any lack of understanding of process step difficulties. After the tests were corrected, any pupil who had attained a perfect score was excused from further drill in that process. Any pupil who failed to attain a perfect score was considered as part of the group who needed corrective work of some kind, in some amount. These pupils make up the CORRECTIVE LOAD.

1. GIVING THE TESTS.

Each teacher gave the tests in her own room. One test a day was given. In order that procedures might be uniform a sheet of instructions was sent to each teacher cooperating in the testing program. The initial tests were given late in October. (SEE EXHIBIT 1 on next two pages.)

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EXHIBIT 1.

INSTRUCTIONS FOR GIVING THE WILSON TESTS IN OCTOBER.

I. PURPOSE.

These tests are given to determine the amount of corrective teaching that is necessary to be done in the four fundamental processes of arithmetic at the sixth grade level in our district.

II. NUMBER OF TESTS TO BE GIVEN.

Each pupil is to be given FOUR different sets of tests, one in each process.

III. INFORMATION REQUIRED.

Please see that the information at the top of each test is filled in carefully. Please put your room number in the upper left hand corner.

IV. TIME TO GIVE THE TESTS.

Start immediately after opening exercises each day to give the tests. GIVE ONE TEST A DAY.

V. TIMING THE TEST.

All start on a given signal.

Teachers will keep a record of the time in minutes on the blackboard. As pupils finish, they will look at the board and put down on their paper the LAST number which they see there. Pupils are to put down only the time it takes them to do the test. If they check their work, the time for the checking is not to be included.

VI. SIGNIFICANCE OF THE TIME ELEMENT.

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WARNING ! ! ! DO NOT STRESS THE TIME. Each pupil is to take as much time as it is necessary for him to complete the tests. This will vary with each test, the long division will probably take the longest time, and multiplication will be a close second.

VII. TEACHER PARTICIPATION.

1. Keep the room as quiet as possible.
2. Avoid distractions.
3. See that each pupil has at least two sharpened pencils on his desk at the beginning of each test.
4. Provide extra work for the pupils who finish early to do, so that they will be busy and quiet.
5. Watch pupils as they work. Make a list for your own future use of all pupils whom you see counting in any form. WARNING ! ! ! DO NOT SAY A WORK ABOUT COUNTING UNTIL TEST IS COMPLETED !
6. When test is completed, ask pupils who know that they counted while doing some of the examples to double check (√ √) in the space provided for it at the top of the addition test.
7. Send all papers to me at the end of the test every day.
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2. CORRECTION OF THE TESTS.

In order to keep conditions uniform, all tests given in this study were corrected by the writer. The same standards of accuracy applied to all pupils and all tests, both initial and re-tests. If a child omitted a decimal point, it was considered an error. The dollar sign does not change the value of the answer, but the decimal point certainly does, so the child should form the habit of labeling money correctly in written work. If he did an example and later found he had made an error and corrected it by crossing out or marking over the first figure, it was considered correct, even though this may be considered an untidy habit by some teachers. In long division the quotient and the remainder, if any, had to be correct, or the example was counted wrong. If the remainder had not been made into a fraction and reduced to lowest terms, this was not counted incorrect, because the pupils had not been taught fractions. The remainder should be correct because they have been taught the process of long division. If commas were not written down, or if they were in the wrong place, this was not counted as an error because they do not affect the value of the answer. In order to be fair and to be able to compare results, all these items should be uniform.

During the corrections of the tests it was possible to notice some very obvious errors. The omission of the decimal point, carrying the wrong figure, forgetting to carry, and lack of knowledge of fundamental facts were some of these errors.

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During the corrections of the tests it was possible to notice some very obvious errors. The omission of the decimal point, carrying the wrong figure, forgetting to carry, and lack of knowledge of fundamental facts were some of these errors.

Lists of specific errors for each process are included later in this study. (See lists under Exhibits 5, 6, 7 and 8.)

3. RECORDING THE RESULTS.

Since a table is the quickest way to show results on a test, this form was used in this study. Individual records of pupils showing Age, I. Q. and the scores and time for each test were made. For this study these tables were so arranged that no pupil's identity is disclosed. A number is given to each pupil. The same number designates the same pupil on both tests, Initial and Re-test. There are a few exceptions which are listed at the bottom of each table. The exceptions include pupils who entered school after the work had begun, and who did not take both tests. This form of record is sometimes easier for the classroom teacher to interpret to determine the individual achievement. The I. Q's were obtained by giving the NATIONAL INTELLIGENCE TEST SCALE A FORM I early in the year. (See Tables I through V.)

Another way the results were recorded were on tables showing the two-way distribution of score and time for each room. The scores are shown in per cents at the left and the time is shown in minutes at the top. This meant that in the initial test each room had four tables showing their results. (See Tables VI through X, XII through XVI, XVIII through XXII, and XXIV through XXVIII.)

Then in order to show how the district stood in a process, four summary tables were made combining the results from all the rooms for that process. (See Tables XI, XVII,

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Then in order to show how the district stood in a process, four summary tables were made combining the results from all the rooms for that process. (See Tables XI, XVII,

XXIII, and XXIX.) The rooms are designated by the initials L, W, J, H, and R.

Tables I to V show the individual records for each pupil including chronological age, I. Q., and results obtained on each of the four process test expressed in score and time. They should be read in the following manner; In Room L pupil 1, aged 10 years, 8 months, with an I. Q. of 123 obtained 88% on A. P. Test in 6 minutes, 84% on S. P. Test in 5 minutes, 68% on M. P. Test in 10 minutes, and 96% on L. D. P. Test in 16 minutes. The same items may be read for any pupil in any room.

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Tables I to V show the individual records for each pupil including chronological age, I. Q., and results obtained on each of the four process best expressed in score and time. They should be read in the following manner: In Room L pupil I, aged 10 years, 8 months, with an I. Q. of 125 obtained 88% on A. F. Test in 6 minutes, 84% on S. F. Test in 8 minutes, 68% on M. F. Test in 10 minutes, and 98% on L. D. F. Test in 16 minutes. The same items may be read for any pupil in any room.

Table I Showing Individual Records of pupils in Room L including chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1938 Yrs.	Mos.	I. Q.	A. P. S %	A. P. T Min.	S. P. S %	S. P. T Min.	M. P. S %	M. P. T Min.	L. D. P. S %	L. D. P. T Min.
1	10	8	123	88	6	84	5	68	10	96	16
2	10	5	122	68	10	88	6	68	11	68	44
3	10	11	100	52	15	68	8	44	17	36	33
4	11	4	113	absent		absent		absent		44	56
5	10	10	106	84	11	88	6	64	19	84	27
6	10	10	115	64	11	88	6	48	15	76	27
7	12	6	84	68	11	60	6	56	13	68	25
8	11	0	131	80	8	96	6	76	15	88	24
9	13	10	62	32	15	36	13	0	9	4	39
10	10	7	103	84	10	68	9	48	15	20	38
11	10	8	83	48	11	absent		0	20	absent	
12	10	5	98	40	12	80	10	36	14	0	19
13	10	4	111	92	14	12	6	28	25	56	31
14	13	7	76	56	13	28	7	40	27	12	25
15	10	10	109	96	6	40	7	44	8	32	38
16	11	1	93	76	13	16	8	24	18	40	48
17	11	9	107	68	9	92	8	44	11	76	19
18	10	8	106	60	7	72	11	0	23	56	34
19	10	6	97	64	9	80	8	36	19	0	33
20	10	6	97	76	10	96	7	48	17	64	26
21	10	6	109	76	11	92	12	20	16	84	31
22	10	10	103	80	12	92	12	68	18	60	38
23	11	1	99	64	11	76	12	52	19	44	28
24	10	5	89	76	11	52	13	12	31	64	43
25	11	0	94	80	13	56	11	48	22	0	25
26	10	6	131	100	7	88	10	64	14	28	43
27	10	8	117	60	9	68	9	48	11	48	33
28	11	5	97	88	11	76	8	16	18	absent	
29	9	9	107	76	14	68	8	56	16	64	30
30	12	4	93	60	23	64	19	12	30	0	27
31	11	0	113	92	8	100	8	76	17	72	30
32	12	9	82	48	12	84	10	48	14	68	35
33	11	0	113	88	4	82	4	52	8	48	18
34	9	11	140	72	9	96	10	48	15	absent	
35	10	3	116	76	6	100	6	60	10	absent	
36	10	8	114	76	12	100	8	72	13	88	23
37	11	0	101	88	10	76	8	76	12	68	28
38	10	4	109	72	10	64	6	92	12	64	32
39	10	2	100	96	7	92	5	72	8	12	16
40	10	8	117	68	8	68	6	32	12	72	30
Total Pupils Tested				39		38		39		36	

Table I Showing Individual Records of pupils in Room I including chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1928 Yrs.	Mos.	T. C. S	T	A. I. S	T	S. P. S	T	M. P. S	T	L. D. P. S	T
			% Min.		% Min.		% Min.		% Min.		% Min.	
1	10	8	128	88	6	84	5	88	10	06	16	
2	10	5	132	68	10	86	6	88	11	08	44	
3	10	11	100	52	16	68	8	44	17	36	56	
4	11	4	113	Absent		Absent		Absent		44	56	
5	10	10	106	84	17	86	6	84	19	84	27	
6	10	10	115	64	11	88	6	48	15	76	27	
7	12	6	84	08	11	60	6	56	13	68	28	
8	11	0	131	80	8	90	6	76	15	88	24	
9	15	10	62	32	16	36	16	0	9	4	29	
10	10	7	103	84	10	86	3	48	16	20	28	
11	10	8	83	48	11	Absent		0	20	Absent		
12	10	6	98	40	12	80	10	36	14	0	19	
13	10	4	111	92	14	12	6	28	26	56	31	
14	13	7	78	56	13	28	7	40	27	12	26	
15	10	10	109	96	6	40	7	44	8	32	28	
16	11	1	93	76	12	16	8	24	18	40	48	
17	11	9	107	68	9	92	8	44	11	76	19	
18	10	8	106	80	7	72	11	0	23	56	34	
19	10	6	97	64	9	80	8	36	19	0	33	
20	10	6	97	76	10	96	7	48	17	64	26	
21	10	6	109	76	11	92	12	20	16	84	31	
22	10	10	108	80	12	92	12	68	18	60	38	
23	11	1	99	84	11	76	12	68	19	44	28	
24	10	5	89	76	11	82	15	12	31	84	43	
25	11	0	94	80	13	68	11	48	22	0	28	
26	10	6	131	100	7	88	10	64	14	28	43	
27	10	8	117	80	9	88	9	48	11	48	33	
28	11	5	97	88	11	76	8	16	18	Absent		
29	9	9	107	76	14	68	8	56	16	64	30	
30	12	4	93	60	23	64	19	12	30	0	17	
31	11	0	113	92	8	100	8	76	17	72	30	
32	12	9	82	48	12	84	10	48	14	68	35	
33	11	0	113	88	4	82	4	82	9	48	18	
34	9	11	140	72	9	96	10	48	15	Absent		
35	10	3	116	76	6	100	6	60	10	Absent		
36	10	8	114	76	12	100	8	72	13	88	23	
37	11	0	101	88	10	76	8	76	12	68	28	
38	10	4	109	72	10	64	6	52	12	64	32	
39	10	2	100	96	7	92	5	72	8	12	16	
40	10	8	117	68	8	68	6	32	12	72	30	
Total Pupils Tested				39		38		39		36		

Table II Showing Individual Records of pupils in Room W including Chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1,1938 Yrs. Mos.	I. Q.	A. P. S %	A. P. T Min.	S. P. S %	S. P. T Min.	M. P. S %	M. P. T Min.	L. D. P. S %	L. D. P. T Min.
1	10 - 4	111	76	7	92	6	48	11	60	30
2	10 - 6	119	84	7	92	4	48	9	80	16
3	10 - 2	100	68	11	92	8	56	14	8	38
4	10 - 8	108	76	10	92	8	44	15	60	23
5	10 - 7	106	88	7	8	7	4	7	0	24
6	12 - 4	77	76	12	80	8	44	14	36	44
7	10 - 2	119	64	14	68	13	28	24	16	30
8	11 - 6	109	60	12	92	7	56	11	92	31
9	10 - 8	114	96	7	96	7	88	11	88	18
10	9 - 5	130	100	8	100	7	72	22	88	33
11	10 -11	127	80	9	92	7	56	13	8	38
12	12 -10	84	56	16	56	14	44	18	12	38
13	11 - 5	102	72	13	96	7	36	20	88	22
14	12 - 7	74	88	8	absent		absent		48	32
15	10 - 3	110	absent		absent		48	17	48	68
16	11 - 4	84	80	11	96	7	60	17	76	23
17	10 - 4	130	88	8	92	7	72	12	80	24
18	9 -11	130	84	13	96	8	64	19	92	23
19	12 - 5	98	72	13	84	10	64	26	68	40
20	11 - 7	87	96	9	96	8	72	13	60	60
21	10 - 4	89	52	11	72	15	16	34	0	37
22	10 - 4	117	48	7	96	7	44	12	40	22
23	10 - 5	111	100	10	96	7	92	14	88	15
24	11 -10	85	88	11	100	9	8	18	80	31
25	10 - 6	130	92	7	92	6	84	14	92	15
26	11 - 7	89	76	7	96	6	80	11	68	20
27	11 - 4	96	84	9	96	7	88	10	68	24
28	12 - 6	89	88	9	84	8	40	12	68	56
29	11 - 0	124	76	7	80	6	36	14	32	27
30	10 - 6	90	88	10	92	7	80	15	92	17
31	10 -11	124	100	6	100	4	76	11	88	16
32	10 - 8	100	88	10	88	9	60	13	40	21
33	11 - 6	109	88	11	96	10	44	16	56	25
34	10 - 1	128	96	10	100	6	56	13	92	21
35	12 - 8	84	96	7	88	4	68	9	88	16
36	12 - 3	89	80	11	92	5	52	12	80	18
37	10 - 6	134	100	9	88	7	44	16	68	20
38	11 - 5	93	72	11	100	9	68	11	72	16
Total Pupils Tested			38		37		38		39	

Table II

Showing Individual Records of Pupils in Room W Including Chronological Age. I. Q.. and Results obtained expressed in Score and Time on each of the Four Process tests on the Initial testing in October.

Pupil	Age Sept. 1.1938 Yrs. Mos.	I. Q.	A. P. S	A. P. T	B. P. S	B. P. T	M. P. S	M. P. T	L. D. P. S	L. D. P. T
			¼ Min.	¼ Min.	¼ Min.	¼ Min.	¼ Min.	¼ Min.	¼ Min.	¼ Min.
1	10 - 4	111	76	7	92	6	48	11	60	30
2	10 - 6	116	84	7	92	4	48	9	80	16
3	10 - 2	100	68	11	92	8	56	14	8	38
4	10 - 8	108	76	10	92	8	44	15	60	23
5	10 - 7	106	88	7	8	7	4	7	0	24
6	12 - 4	77	76	12	80	8	44	14	36	44
7	10 - 2	119	64	14	68	13	28	24	16	30
8	11 - 6	109	80	12	92	7	56	11	92	31
9	10 - 8	114	96	7	96	7	88	11	88	18
10	9 - 6	130	100	8	100	7	72	28	88	83
11	10 -11	127	80	9	92	7	56	13	8	58
12	12 -10	84	56	16	56	14	44	18	12	38
13	11 - 5	102	72	13	96	7	36	20	88	22
14	12 - 7	74	88	8	absent		absent		48	32
15	10 - 3	110	absent		absent		40	17	48	88
16	11 - 4	84	60	11	96	7	80	17	76	23
17	10 - 4	120	88	8	92	7	72	12	80	24
18	9 -11	130	84	13	96	8	64	19	92	23
19	12 - 5	88	72	13	84	10	64	28	88	40
20	11 - 7	87	88	9	96	8	72	13	80	80
21	10 - 4	89	52	11	72	15	16	54	0	37
22	10 - 4	117	48	7	96	7	44	12	40	22
23	10 - 5	111	100	10	96	7	92	14	88	15
24	11 -10	86	88	11	100	9	8	18	80	31
25	10 - 6	120	92	7	92	6	84	14	92	15
26	11 - 7	89	76	7	96	6	80	11	88	20
27	11 - 4	98	84	9	96	7	88	10	68	24
28	12 - 6	89	88	9	84	8	40	12	68	56
29	11 - 0	124	76	7	80	6	36	14	32	27
30	10 - 6	90	88	10	92	7	80	15	92	17
31	10 -11	124	100	6	100	4	76	11	88	16
32	10 - 8	100	88	10	88	9	60	13	40	21
33	11 - 6	109	88	11	96	10	44	16	56	28
34	10 - 1	128	96	10	100	6	56	13	92	21
35	12 - 8	84	96	7	88	4	68	9	88	16
36	12 - 3	88	80	11	92	8	52	12	80	18
37	10 - 6	124	100	9	88	7	44	16	68	20
38	11 - 5	95	72	11	100	9	68	11	72	16
Total Pupils Tested		36		37		38		39		

Table III Showing Individual Records of pupils in Room J including Chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1938 Yrs.	Mos.	I. Q.	A. P. S %	A. P. T Min.	S. P. S %	S. P. T Min.	M. P. S %	M. P. T Min.	L. D. P. S %	L. D. P. T Min.
1	11	7	117	88	5	96	4	84	7	84	11
2	11	5	107	76	8	88	6	68	13	64	16
3	10	11	100	absent		absent		absent		absent	
4	11	0	93	72	19	72	18	48	20	88	35
5	10	7	109	56	8	88	6	76	11	88	10
6	13	8		absent		96	10	68	11	84	19
7	10	3	119	absent		76	10	76	14	92	14
8	11	6	100	92	9	92	8	60	9	96	22
9	10	10	108	absent		88	12	52	12	84	20
10	11	9	99	96	7	88	10	64	10	84	20
11	9	11	127	absent		100	6	92	10	100	9
12	10	10	115	92	7	84	5	72	11	84	13
13	10	11	106	84	8	80	8	absent		60	13
14	11	5	116	100	11	96	8	60	12	80	19
15	11	2	100	72	13	68	14	28	16	40	23
16	10	8	114	92	8	96	5	76	12	96	13
17	11	10	89	92	9	76	9	68	7	72	16
18	10	0	102	76	13	88	6	56	11	96	13
19	11	0	99	88	7	92	4	56	9	100	7
20	10	0	111	84	10	84	8	76	12	84	16
21	11	9	106	96	6	96	4	80	9	72	13
22	9	8	129	92	7	88	6	76	6	92	10
23	11	5	107	92	7	76	6	36	12	48	19
24	11	3	97	100	8	92	5	48	16	80	17
25	12	9	69	92	9	64	7	88	12	68	15
26	11	8	93	76	13	92	6	80	15	88	15
27	11	3	115	100	7	84	4	72	8	88	11
28	11	2	100	96	10	72	6	60	9	72	16
29	10	10	109	80	10	96	10	68	17	absent	
30	12	4	78	60	15	80	12	4	10	52	29
31	11	3	115	92	11	88	6	76	13	92	16
32	10	7	106	96	10	84	9	56	13	88	25
33	9	11	133	96	10	84	6	76	13	88	17
34	10	1	121	84	10	absent		60	14	84	19
35	10	10	106	80	7	100	5	72	7	100	9
36	12	0	82	88	6	68	6	72	12	68	30
37	12	1	90	88	11	80	7	24	7	80	10
38	10	9	118	92	8	100	6	80	9	84	14
Total Pupils Tested				33		36		36		36	

Table III

Showing Individual Records of pupils in Room I including Chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1938 Yrs. Mos.	I. Q.	A. P. S	A. P. T	S. P. S	S. P. T	M. P. S	M. P. T	L. D. P. S	L. D. P. T
			% Min.		% Min.		% Min.		% Min.	
1	11 - 7	117	88	5	96	4	84	7	84	11
2	11 - 5	107	76	3	88	6	68	13	64	16
3	10 -11	100	absent		absent		absent		absent	
4	11 - 0	93	72	19	72	18	48	20	88	35
5	10 - 7	109	56	3	88	6	76	11	88	10
6	13 - 8		absent		96	10	68	11	84	19
7	10 - 3	119	absent		76	10	76	14	92	14
8	11 - 6	100	92	9	92	8	60	9	96	22
9	10 -10	108	absent		88	12	52	12	84	20
10	11 - 9	99	96	7	88	10	64	10	84	20
11	9 -11	127	absent		100	6	92	10	100	9
12	10 -10	115	92	7	84	5	72	11	84	13
13	10 -11	106	84	8	80	8	absent		60	13
14	11 - 5	116	100	11	96	8	60	12	80	19
15	11 - 2	100	72	13	68	14	28	16	40	23
16	10 - 8	114	92	8	95	5	76	12	96	13
17	11 -10	89	92	9	76	9	68	7	72	16
18	10 - 0	102	76	13	88	6	56	11	96	13
19	11 - 0	99	88	7	92	4	56	9	100	7
20	10 - 0	111	84	10	84	8	76	12	84	16
21	11 - 9	106	96	6	96	4	80	9	72	13
22	9 - 8	129	92	7	88	6	76	6	92	10
23	11 - 5	107	92	7	76	6	36	12	48	19
24	11 - 3	97	100	8	92	5	48	16	80	17
25	12 - 9	69	92	9	64	7	88	12	68	15
26	11 - 8	93	76	13	92	6	80	15	88	15
27	11 - 3	115	100	7	84	4	72	8	88	11
28	11 - 2	100	96	10	72	6	60	9	72	16
29	10 -10	109	80	10	96	10	68	17	absent	
30	12 - 4	78	60	15	80	12	4	10	52	29
31	11 - 3	115	92	11	88	6	76	13	92	16
32	10 - 7	106	96	10	84	9	56	13	88	25
33	9 -11	133	96	10	84	6	76	13	88	17
34	10 - 1	121	84	10	Absent		60	14	84	19
35	10 -10	106	80	7	100	5	72	7	100	9
36	12 - 0	82	88	6	68	6	72	12	68	30
37	12 - 1	90	88	11	80	7	24	7	80	10
38	10 - 9	113	92	8	100	6	80	9	84	14
Total Pupils Tested			33		36		36		36	

Table IV Showing Individual Records of pupils in Room H including Chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1938 Yrs. Mos.	I. Q.	A. P. S %	A. P. T Min.	S. P. S %	S. P. T Min.	M. P. S %	M. P. T Min.	L. D. P. S %	L. D. P. T Min.
1	11 - 9	92	80	5	92	4	80	10	48	24
2	10 - 7	109	88	12	52	11	48	20	64	29
3	11 - 6	100	80	18	100	9	64	26	88	27
4	11 - 6	106	88	14	absent		68	17	64	50
5	10 - 5	92	68	15	92	7	24	19	80	35
6	12 - 4	91	84	11	72	11	40	13	76	36
7	12 - 0	82	76	13	96	6	48	17	72	20
8	11 - 5	122	96	8	92	3	76	8	84	24
9	10 - 7	88	76	8	48	3	absent		40	24
10	13 - 1	70	76	20	48	21	68	19	12	50
11	10 - 4	102	100	15	84	11	24	10	76	35
12	10 -11	112	100	6	96	5	96	10	80	20
13	14 - 6	64	44	7	4	8	0	6	0	20
14	12 - 2	76	92	9	68	6	60	12	68	23
15	11 - 7	86	100	8	96	6	44	11	16	50
16	10 -10	100	72	12	88	8	60	14	76	20
17	10 - 6	100	76	14	52	9	60	13	64	26
18	11 - 8	91	92	10	100	5	76	20	72	40
19	10 - 1	131	92	6	96	6	76	8	80	25
20	12 - 4	83	92	10	84	8	48	12	76	22
21	10 -10	91	100	9	60	8	48	10	68	20
22	10 - 4	108	84	15	88	9	76	26	76	50
23	10 - 8	114	96	7	88	7	44	13	absent	
24	11 - 6	121	100	3	96	3	68	8	96	15
25	12 - 0	90	100	6	92	5	84	10	80	15
26	10 - 4	108	92	10	92	6	80	10	88	23
27	11 - 6	90	96	16	76	12	28	22	16	50
28	11 - 1	87	88	13	92	9	64	16	84	27
29	11 - 1	81	80	23	absent		64	23	48	50
30	10 -10	114	100	10	88	8	80	17	88	30
31	10 - 6	106	80	7	92	6	44	11	96	18
32	10 - 8	102	88	10	absent		76	10	88	23
33	12 - 2	103	64	13	76	9	52	20	88	43
34	9 -11	107	84	11	100	11	72	14	88	25
35	12 - 5	82	absent		72	9	76	14	68	24
36	11 - 3		absent		absent		absent		56	50
37	10 - 9	123	92	8	96	6	absent		absent	
38	9 -11	103	84	19	96	14	60	23	100	21
39	11 - 2	71	84	18	92	9	60	13	64	22
Total Pupils Tested			37		35		36		37	

Table IV

Showing Individual Records of pupils in Room E including Chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1928 Yrs. Mon.	I. Q.	A. P.	S. P.	M. P.	I. D. T.
			S T	S T	S T	S T
			% Min.	% Min.	% Min.	% Min.
1	11 - 9	92	80 5	92 4	80 10	45 24
2	10 - 7	109	88 12	82 11	68 20	64 29
3	11 - 6	100	80 18	100 9	84 36	88 27
4	11 - 6	108	88 14	Absent	92 IV	84 50
5	10 - 5	82	88 15	92 7	24 19	80 35
6	12 - 4	91	84 11	72 11	40 13	76 36
7	12 - 0	82	76 13	96 6	48 17	72 20
8	11 - 5	122	96 8	92 3	76 8	84 24
9	10 - 7	88	76 8	48 3	Absent	40 24
10	13 - 1	70	76 20	48 21	68 19	12 30
11	10 - 4	102	100 18	84 11	24 10	76 35
12	10 -11	112	100 6	96 5	96 10	80 20
13	14 - 8	84	44 7	4 8	0 6	0 20
14	12 - 3	76	92 9	68 6	60 12	68 25
15	11 - 7	86	100 8	96 6	44 11	16 30
16	10 -10	100	72 12	88 8	60 14	76 20
17	10 - 6	100	76 14	32 9	80 12	84 28
18	11 - 8	81	92 10	100 5	76 20	72 40
19	10 - 1	121	92 6	96 6	76 8	80 28
20	12 - 4	85	92 10	84 8	48 12	76 28
21	10 -10	91	100 9	80 8	48 10	68 20
22	10 - 4	108	84 12	88 9	76 28	76 30
23	10 - 8	114	96 7	88 7	44 12	Absent
24	11 - 8	121	100 8	96 5	68 8	96 16
25	12 - 0	90	100 6	92 6	84 10	80 16
26	10 - 4	108	72 10	92 6	80 10	88 28
27	11 - 6	90	96 16	76 12	88 22	16 30
28	11 - 1	87	88 12	92 8	64 16	84 27
29	11 - 1	81	80 28	Absent	64 28	48 30
30	10 -10	114	100 10	88 8	80 17	88 30
31	10 - 6	106	80 7	92 6	44 11	96 18
32	10 - 8	102	88 10	Absent	76 10	88 28
33	12 - 2	105	64 12	76 9	32 20	88 40
34	9 -11	107	84 11	100 11	72 14	88 28
35	12 - 8	82	Absent	72 9	76 14	68 24
36	11 - 5		Absent	Absent	Absent	36 30
37	10 - 9	123	92 8	96 6	Absent	Absent
38	9 -11	105	84 12	96 14	80 28	100 21
39	11 - 2	71	84 18	92 9	60 12	64 22
Total Pupils Tested		37	36	36		37

Table V Showing Individual Records of pupils in Room R including Chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1938 Yrs. Mos.	I. Q. S	A. P. S %	A. P. T Min.	S. P. S %	S. P. T Min.	M. P. S %	M. P. T Min.	L. D. P. S %	L. D. P. T Min.
1	9 - 9	139	100	5	100	4	92	8	100	12
2	13 - 1	78	92	7	absent		16	13	28	40
3	10 - 5	102	84	9	88	8	52	11	84	34
4	11 - 0	115	92	10	100	7	68	13	96	19
5	12 - 4	108	96	9	64	10	72	13	72	27
6	11 - 4	113	100	7	92	6	72	9	80	20
7	11 - 2	103	72	9	88	9	68	18	72	35
8	13 - 5	83	72	8	76	16	60	17	56	40
9	10 - 8	98	96	9	96	6	84	13	100	16
10	10 - 0	125	92	7	100	4	80	10	88	12
11	12 - 1	79	76	10	92	7	60	11	80	22
12	13 - 6	78	84	20	80	14	68	15	64	40
13	10 -10	109	88	14	92	9	84	17	84	26
14	10 - 9	109	100	12	100	7	88	12	84	18
15	12 - 2	96	76	10	80	13	76	14	88	36
16	10 - 0	121	92	9	96	7	64	13	88	19
17	10 - 0	108	88	10	96	7	72	12	80	21
18	11 - 2	124	80	8	60	7	76	9	52	24
19	10 - 1	105	92	13	100	7	56	10	68	25
20	10 - 4	114	72	9	76	5	56	10	92	21
21	12 - 0	96	96	5	96	11	52	9	absent	
22	10 - 3	100	84	16	84	9	92	13	92	12
23	11 - 0	106	72	12	88	7	80	12	80	33
24	9 -11	110	68	10	96	10	44	13	68	36
25	10 -11	82	72	16	96	9	68	13	76	24
26	10 -10	112	96	9	100	7	84	10	92	18
27	13 - 8	68	100	10	60	10	36	13	12	20
28	10 -11	115	72	9	absent		64	10	76	19
29	10 - 2	116	80	11	84	7	84	16	56	23
30	10 - 9		100	10	88	7	84	13	84	23
31	10 - 9	117	96	5	96	5	92	9	80	15
32	11 - 4	90	76	7	92	7	64	13	52	26
33	12 - 1	90	92	11	80	10	80	13	48	20
34	11 -10	110	92	9	96	8	72	14	80	27
35	10 - 4	133	96	9	96	7	92	21	84	29
36	11 - 1		absent		absent		absent		60	40
37	12 - 1	92	80	6	64	6	60	7	84	40
38	11 - 1	100	92	9	80	5	88	9	84	17
39	11 - 3	119	96	10	88	6	64	10	76	19
Total Pupils Tested			38		36		38		38	

Table V Showing Individual Records of pupils in Room B including Chronological age, I. Q., and results obtained expressed in Score and Time on each of the four process tests on the Initial testing in October.

Pupil	Age Sept. 1, 1938 Yrs. Mos.	I. Q. S	A. P. S	A. P. T	S. P. S	S. P. T	M. P. S	M. P. T	L. D. P. S	L. D. P. T
				% Min.		% Min.		% Min.		% Min.
1	9 - 9	139	100	5	100	4	92	8	100	12
2	13 - 1	78	92	7	absent		16	13	28	40
3	10 - 5	102	84	9	88	8	52	11	84	34
4	11 - 0	115	92	10	100	7	68	13	96	19
5	12 - 4	108	96	9	64	10	72	13	72	27
6	11 - 4	113	100	7	92	6	72	9	80	20
7	11 - 2	103	72	9	88	9	68	18	72	35
8	13 - 5	83	72	8	76	15	60	17	56	40
9	10 - 8	98	96	9	96	6	84	13	100	16
10	10 - 0	125	92	7	100	4	80	10	88	12
11	12 - 1	79	76	10	92	7	60	11	80	22
12	13 - 6	73	84	20	80	14	68	15	64	40
13	10 -10	109	88	14	92	9	84	17	84	26
14	10 - 9	109	100	12	100	7	88	12	84	18
15	12 - 2	96	76	10	80	13	76	14	88	36
16	10 - 0	121	92	9	96	7	64	13	88	19
17	10 - 0	108	88	10	96	7	72	12	80	21
18	11 - 2	124	80	8	60	7	76	9	52	24
19	10 - 1	105	92	13	100	7	56	10	68	25
20	10 - 4	114	72	9	76	5	56	10	92	21
21	12 - 0	95	96	5	96	11	52	9	absent	
22	10 - 3	100	84	16	84	9	92	13	92	12
23	11 - 0	106	72	12	88	7	80	12	80	33
24	9 -11	110	68	10	96	10	44	13	68	36
25	10 -11	82	72	16	96	9	68	13	76	24
26	10 -10	112	96	9	100	7	84	10	92	18
27	13 - 8	68	100	10	60	10	36	13	12	20
28	10 -11	115	72	9	absent		64	10	76	19
29	10 - 2	116	80	11	84	7	84	16	56	23
30	10 - 9		100	10	88	7	84	13	84	23
31	10 - 9	117	96	5	96	5	92	9	80	15
32	11 - 4	90	76	7	92	7	64	13	52	26
33	12 - 1	90	92	11	80	10	80	13	48	20
34	11 -10	110	92	9	96	8	72	14	80	27
35	10 - 4	133	96	9	96	7	92	21	84	29
36	11 - 1		absent		absent		absent		60	40
37	12 - 1	92	80	6	64	6	60	7	84	40
38	11 - 1	100	92	9	80	5	88	9	84	17
39	11 - 3	119	96	10	88	6	64	10	76	19
Total Pupils Tested			38		36		38		38	

4. DIAGNOSIS OF RESULTS OF ALL CLASSES TO DETERMINE THE CORRECTIVE LOAD, INCLUDING INTERPRETATION OF RESULTS

(a) ADDITION

Standards adopted.

Accuracy 100% Time 8 minutes.

In order to determine the corrective load, these Tables were analyzed very carefully. They should be interpreted in the following manner. In Room L shown on Table VI, 39 pupils were tested. Of this number 1 pupil received 100% in 7 minutes, 2 had 96%, 2 had 92%, 4 had 88%, 2 had 84%, 3 had 80%, 7 had 76% and so on. The range in score was from 100% to 32%. The range in time was from 4 to 23 minutes. This room attained a median score of 76% and a median time of 11 minutes. The mean score was 71.64% and the mean time was 10.51 minutes. Thus only one pupil, or 2.56% of the class is up to standard in addition and so may be excused from further drill. The other 38 pupils or 97.44% need corrective work in addition.

Table VII shows that in Room W 4 pupils out of 38 attained 100% in time ranging from 6 to 10 minutes. The results show a range in score from 100% to 48%. The time ranged from 6 to 16 minutes. The median score was 84% and the median time was 10 minutes. The mean score was 78.84% and the mean time was 9.76 minutes. In this room 36 pupils out of the 38, or 94.74% of the class need corrective work in addition. Two of the pupils who attained perfect scores were beyond the time standard of 8 minutes so they are included in the number who need corrective work. Thus only 2 or 5.26% of pupils in this

4. DIAGNOSIS OF RESULTS OF ALL CLASSES TO DETERMINE THE CORRECTIVE LOAD, INCLUDING INTERPRETATION OF RESULTS

(a) ADDITION

Standards adopted.

Accuracy 100% Time 8 minutes.

In order to determine the corrective load, these Tables were analyzed very carefully. They should be interpreted in the following manner. In Room I shown on Table VI, 39 pupils were tested. Of this number 1 pupil received 100% in 7 minutes, 2 had 96%, 2 had 92%, 4 had 88%, 2 had 84%, 3 had 80% 7 had 76% and so on. The range in score was from 100% to 32%. The range in time was from 4 to 23 minutes. This room attained a median score of 76% and a median time of 11 minutes. The mean score was 71.64% and the mean time was 10.81 minutes. Thus only one pupil, or 2.56% of the class is up to standard in addition and so may be excused from further drill. The other 38 pupils or 97.44% need corrective work in addition.

Table VII shows that in Room W 4 pupils out of 38 attained 100% in time ranging from 8 to 30 minutes. The results show a range in score from 100% to 48%. The time ranged from 8 to 16 minutes. The median score was 84% and the median time was 10 minutes. The mean score was 78.84% and the mean time was 9.76 minutes. In this room 33 pupils out of the 38, or 94.74% of the class need corrective work in addition. Two of the pupils who attained perfect scores were beyond the time standard of 8 minutes so they are included in the number who need corrective work. Thus only 2 or 5.26% of pupils in this

Table VI Showing distribution of Scores and Time made by pupils of Room L on initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	4	6	7	8	9	10	11	12	13 to 15	23	Totals	Percentage at each point
100			1								1	2.56
96		1	1								2	5.12
92				1					1		2	5.12
88	1	1				1	1				4	10.24
84						1	1				2	5.12
80				1				1	1		3	7.68
76		1				1	2	1	2		7	17.92
72					1	1					2	5.12
68				1	1	1	1				4	10.24
64					1		2				3	7.68
60			1		1					1	3	7.68
56									1		1	2.56
52									1		1	2.56
48							1	1			2	5.12
44												
40								1			1	2.56
36												
32									1		1	2.56
	1	3	3	3	4	5	8	4	7	1	39	99.84

	Score	Time
Median	76%	11 Minutes
Q1	64%	8 "
Q3	84%	12 "
Mean	71.64%	10.51 Minutes

Pupils up to accuracy and time standards 1 or 2.56%

Table VI Showing distribution of Scores and Time made by pupils of Room L on initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES												
in %	4	6	7	8	9	10	11	12	13 to 15	25	Totals	Percentage at each point
100			1								1	2.56
96		1	1								2	5.12
92				1					1		2	5.12
88	1	1				1	1				4	10.24
84						1	1				2	5.12
80				1				1	1		3	7.68
76		1				1	2	1	2		7	17.92
72					1	1					2	5.12
68				1	1	1	1				4	10.24
64					1		2				3	7.68
60			1		1					1	3	7.68
56									1		1	2.56
52									1		1	2.56
48							1	1			2	5.12
44												
40								1			1	2.56
36												
32									1		1	2.56
	1	3	3	3	4	5	8	4	7	1	39	99.84

	Score	Time
Median	76%	11 Minutes
Q1	64%	8 "
Q3	84%	12 "
Mean	71.64%	10.51 Minutes

Pupils up to accuracy and time standards 1 or 2.56%

Table VII Showing distribution of Scores and Time made by pupils of Room W on initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 6	7	8	9	10	11	12	13	14	16	Totals	Percentage at each point
100	1		1	1	1						4	10.52
96		2		1	1						4	10.52
92		1									1	2.63
88		1	2	1	2	2					8	21.04
84		1		1				1			3	7.89
80				1		2		1			4	10.52
76		3			1		1				5	13.15
72						1		2			3	7.89
68						1					1	2.63
64									1		1	2.63
60							1				1	2.63
56										1	1	2.63
52						1					1	2.63
48		1									1	2.63
	1	9	3	5	5	7	2	4	1	1	38	99.94

	Score	Time
Median	84%	10 Minutes
Q1	76%	7 Minutes
Q3	88%	11 Minutes
Mean	78.8 4%	9.76 Minutes

Pupils up to accuracy and time standards 2 or 5.26%

Table VII Showing distribution of Scores and Time made by pupils of Room W on Initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES																Totals	Percentage at each point
in %	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
100	1		1		1												4	10.52
96		2		1	1												4	10.52
92		1															1	2.63
88		1	2	1	2	2											8	21.04
84		1		1				1									3	7.89
80				1		2		1									4	10.52
76		3			1		1										5	13.15
72						1		2									3	7.89
68						1											1	2.63
64									1								1	2.63
60							1										1	2.63
56											1		1				1	2.63
52						1											1	2.63
48		1															1	2.63
	1	9	3	3	5	7	2	4	1	1	38							99.94

	Score	Time
Median	84%	10 Minutes
Q1	76%	9 Minutes
Q3	88%	11 Minutes
Mean	78.8 +4	9.76 Minutes

Pupils up to accuracy and time standards 2 or 5.26%

class are up to both accuracy and time standards and may be excused.

In Room J as shown on Table VIII, 3 pupils attained a perfect score in time ranging from 7 to 11 minutes. The range in score was from 100% to 56%. The range in time was from 5 to 19 minutes. The median score was 88%, and the median time was 9 minutes. The mean score was 86.67%, and the mean time was 9.30 minutes. In this class, 31 out of 33, or 93.94% of the class need corrective work in addition. One of the pupils who had 100% score was beyond the time standard of 8 minutes, so he was included in the corrective group. Thus 2 pupils or 6.06% are up to both accuracy and time standards and so may be excused.

In Room H as shown on Table IX, 7 pupils attained a perfect score in time ranging from 3 to 15 minutes. The range in score was from 100% to 44%. The range in time was from 3 to 23 minutes. The median score was 88%, and the median time was 10 minutes. The mean score was 86.05%, and the mean time was 13.75 minutes. Because 3 out of the 7 perfect scores were beyond the time standard of 8 minutes, only 4 pupils or 10.80% are up to standard and so may be excused from further drill in addition. Thus in this room, 33 out of 37 pupils, or 89.20% of the class need corrective work in addition.

In Room R as shown on Table X, 5 pupils attained a perfect score in time ranging from 5 to 12 minutes. The range in scores was from 100% to 68%. The range in time was from 5 to 20 minutes. The median score was 88%, and the median time

Table VIII Showing distribution of Score and Time made by pupils of Room J on initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 5	6	7	8	9	10	11	13	15	19	Totals	Percentage at each point
100			1	1			1				3	9.09
96		1	1			3					5	15.15
92			3	2	3		1				9	27.27
88	1	1	1				1				4	12.12
84				1		2					3	9.09
80			1			1					2	6.06
76				1				2			3	9.09
72								1		1	2	6.06
68												
64												
60									1		1	3.03
56				1							1	3.03
	1	2	7	6	3	6	3	3	1	1	33	99.99

	Score	Time
Median	88%	9 Minutes
Q1	80%	7 Minutes
Q3	92%	11 Minutes
Mean	86.67%	9.30 Minutes

Pupils up to accuracy and time standards 2 or 6.06%

Table VIII — Showing distribution of Score and Time made by pupils of Room 2 on Initial A. E. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES													Totals	Percentage at each point
in %	5	6	7	8	9	10	11	13	15	19					
100				1	1		1							3	9.09
96			1	1		3								5	15.15
92				3	2	3	1							9	27.27
88		1	1	1			1							4	12.12
84					1		2							3	9.09
80				1		1								2	6.06
76					1			2						3	9.09
72								1		1				2	6.06
68															
64															
60									1					1	3.03
56					1									1	3.03
	1	2	7	6	3	4	5	3	1	1				33	99.99

	Score	Time
Median	88%	8 Minutes
Q1	80%	7 Minutes
Q3	92%	11 Minutes
Mean	86.07%	9.30 Minutes

Pupils up to accuracy and time standards 9 or 6.06%

Table IX Showing distribution of Score and Time made by pupils of Room H on initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	3 to 5	6	7	8	9	10	11	12	13 to 15	16 to 23	Totals	Percentage at each point
100	1	2		1	1	1			1		7	18.90
96			1	1						1	3	8.10
92		1		1	1	3					6	16.20
88						1		1	2		4	10.80
84	1						2			2	5	13.50
80	1		1							2	4	10.80
76				1					2	1	4	10.80
72								1			1	2.70
68									1		1	2.70
64									1		1	2.70
60												
44			1								1	2.70
	3	3	3	4	2	5	2	2	7	6	37	99.90

	Score	Time
Median	88%	10 Minutes
Q1	80%	8 Minutes
Q3	92%	14 Minutes
Mean	86.05%	13.75 Minutes

Pupils up to accuracy and time standards 4 or 10.80%

Table IX Showing distribution of Scores and Time made by pupils of Room H on Initial A. T. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES														
in %	3 to 5	6	7	8	9	10	11	12	13 to 15	16 to 23	Totals	Percentage at each point
100	1	2		1	1	1			1		7	18.90
96			1	1						1	3	8.10
92		1		1	1	3					6	16.20
88						1		1	2		4	10.80
84	1						2			2	5	13.50
80	1		1							2	4	10.80
76				1					2	1	4	10.80
72								1			1	2.70
68									1		1	2.70
64									1		1	2.70
60												
44			1								1	2.70
	3	3	3	4	2	5	2	2	7	6	37	99.90

	Score	Time
Median	88%	10 Minutes
Q1	80%	8 Minutes
Q3	93%	14 Minutes
Mean	86.05%	13.75 Minutes

Pupils up to accuracy and time standards 4 or 10.80%

Table X Showing distribution of Score and Time made by pupils of Room R on initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 5	6	7	8	9	10	11	12	13	14 to 20	Totals	Percentage at each point
100	1		1			2		1			5	13.25
96	2				4	1					7	18.55
92			2		3	1	1		1		8	21.20
88						1				1	2	5.30
84					1					2	3	7.95
80		1		1			1				3	7.95
76			1			2					3	7.95
72				1	3			1		1	6	15.90
68						1					1	2.65
	3	1	4	2	11	8	2	2	1	4	38	100.70

	Score	Time
Median	88%	9 Minutes
Q1	76%	8 Minutes
Q3	96%	11 Minutes
Mean	86.94%	9.71 Minutes

Pupils up to accuracy and time standards 2 or 5.30%

was 9 minutes. The mean score was 86.94%, and the mean time was 9.71 minutes. Because 3 of the 5 perfect scores were beyond the time standard of 8 minutes, 36 out of 38 pupils, or 94.70% of the class need corrective work in addition. Only 2 pupils or 5.30% could be excused from further drill.

SUMMARY RESULTS OF ADDITION.

Table XI is the summary table for addition. This table shows that out of the 185 pupils tested in addition only 20, had perfect scores in time ranging from 3 to 15 minutes. Even among this number there are probably some who have poor work habits or are counting in some way as is shown by the long time they took. Applying the accuracy standard and the time standard of 8 minutes, it is seen that out of these 20 only 11 are pupils meet both standards. The range in scores for the entire group was from 100% to 32% and the range in time was from 3 to 23 minutes. The median score was 84% for the entire group, and the median time was 10 minutes. The mean score was 82.59% and the mean time was 10.34 minutes. Thus it is seen that out of the 185 pupils only 11, or 5.94% may be excused from further drill in addition. This also means that 94.06% of the group need corrective work in addition. Therefore these 174 pupils (or 94.06%) form the corrective load in addition in this district.

In the same way the corrective load in the other processes were determined.

(2) SUBTRACTION.

Standards adopted.

Accuracy 100% Time 8 minutes.

was 8 minutes. The mean score was 86.09%, and the mean time was 9.71 minutes. Because 3 of the 3 perfect scores were beyond the time standard of 8 minutes, 36 out of 38 pupils, or 94.70% of the class need corrective work in addition. Only 2 pupils or 5.30% could be excused from further drill.

SUMMARY RESULTS OF ADDITION.

Table XI is the summary table for addition. This table shows that out of the 186 pupils tested in addition only 20, had perfect scores in time ranging from 3 to 18 minutes. Even among this number there are probably some who have poor work habits or are counting in some way as is shown by the long time they took. Applying the accuracy standard and the time standard of 8 minutes, it is seen that out of these 20 only 11 pupils meet both standards. The range in scores for the entire group was from 100% to 32% and the range in time was from 3 to 29 minutes. The median score was 84% for the entire group, and the median time was 10 minutes. The mean score was 82.59% and the mean time was 10.24 minutes. Thus it is seen that out of the 186 pupils only 11, or 5.94% may be excused from further drill in addition. This also means that 94.08% of the group need corrective work in addition. Therefore these 174 pupils (or 94.08%) form the corrective load in addition in this district.

In the same way the corrective load in the other processes were determined.

(3) SUBTRACTION.

Standards adopted.

Accuracy 100% Time 8 minutes.

Table XI Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J, H, R, on initial A. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 3 to 5	6	7	8	9	10	11	12	13	14 & 15	16 to 23	Totals	Percentage at each point
100	2	3	3	3	2	4	1	1		1		20	10.80
96	2	2	5	1	5	5					1	21	11.34
92		1	6	4	7	4	2		1	1		26	14.04
88	2	2	2	2	1	5	4	1	1	2		22	11.88
84	1		1	1	2	3	3		1		4	16	8.64
80	1	1	2	2	1	1	3	1	2		2	16	8.64
76		1	4	2		4	2	2	5	1	1	22	11.88
72				1	4	1	2	1	3		2	14	7.56
68				1	1	2	2			1		7	3.78
64					1		2		1	1		5	2.70
60			1		1			1		1	1	5	2.70
56				1					1		1	3	1.62
52							1			1		2	1.08
48			1			1	1					3	1.62
44			1									1	.54
40								1				1	.54
36													
32										1		1	.54
	8	10	26	18	25	30	23	8	15	10	12	185	99.90

	Score	Time
Median	84%	10 Minutes
Q1	76%	8 "
Q3	92%	11 "
Mean	82.59%	10.34 Minutes

Pupils up to accuracy and time standards 11 or 5.94%

Table XI Summary Table - Showing distribution of Scores and Time made by pupils of Rooms 1, 2, 3, 4, on initial A. T. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES																Totals	Percentage at each point
	5	6	7	8	9	10	11	12	13	14 & 15	16 to 25							
100	2	3	3	3	2	4	1	1		1							20	10.80
96	2	2	5	1	3	6					1						21	11.34
92		1	6	4	7	4	3		1	1							26	14.04
88		2	2	2	1	5	4	1	1	2							22	11.88
84	1		1	1	3	3	3		1		4						16	8.64
80	1	1	2	3	1	1	3	1	2		2						18	8.64
76		1	4	2		4	2	2	3	1	1						22	11.88
72				1	4	1	3	1	3		2						14	7.56
68				1	1	2	3			1							7	3.78
64					1		3		1								5	2.70
60			1		1			1		1	1						5	2.70
56				1			1			1							3	1.62
52						1			1								2	1.08
48			1		1	1											3	1.62
44			1														1	.54
40							1										1	.54
36																		
32									1								1	.54
	3	10	26	18	26	30	23	8	15	10	12						185	99.90

Median	Score	Time
92	84%	10 Minutes
96	76%	8 "
98	92%	11 "

Mean 82.89% 10.34 Minutes

Pupils up to accuracy and time standards 11 or 5.94%

The results for subtraction were tabulated the same way. Table XII shows that in Room L only 3 pupils attained a perfect score in time ranging from 6 to 8 minutes. The range in score was from 100% to 12%, and the range in time was from 4 to 19 minutes. The median score was 76% and the median time was 8 minutes. The mean score was 73.36% and the mean time was 8.44 minutes. In this room 35 pupils out of 38 pupils, or 91.95% of the class need corrective work in subtraction, 3 pupils or 7.89% are excused.

Table XIII shows that in Room W 5 pupils attained perfect scores in time ranging from 4 to 9 minutes. The range in score was from 100% to 56%, and the range in time was from 4 to 16 minutes. The median score was 92% and the median time was 7 minutes. The mean score was 89.51% and the mean time was 8.05 minutes. Because 2 pupils out of the 5 who had perfect scores were beyond the time standard of 8 minutes, only 3 pupils or 8.10% may be excused from further drill. Then in this room 34 out of 37, or 91.90% need corrective work in subtraction.

Table XIV shows that in Room J 3 pupils attained a perfect score in time ranging from 5 to 6 minutes. The range in score was from 100% to 64%, and the range in time was from 4 to 18 minutes. The median score was 88%, and the median time was 6 minutes. The mean score was 85.89%, and the mean time was 7.44 minutes. Thus in Room J 33 pupils out of 37, or 91.66% need corrective work in subtraction, 3 pupils or 8.34% are excused.

The results for subtraction were tabulated the same way. Table XII shows that in Room L only 3 pupils attained a perfect score in time ranging from 8 to 9 minutes. The range in score was from 100% to 12%, and the range in time was from 4 to 19 minutes. The median score was 76% and the median time was 8 minutes. The mean score was 73.36% and the mean time was 8.44 minutes. In this room 36 pupils out of 38 pupils, or 91.89% of the class need corrective work in subtraction. 3 pupils or 7.89% are excused.

Table XIII shows that in Room W 5 pupils attained perfect scores in time ranging from 4 to 9 minutes. The range in score was from 100% to 68%, and the range in time was from 4 to 19 minutes. The median score was 88% and the median time was 7 minutes. The mean score was 89.81% and the mean time was 8.08 minutes. Because 3 pupils out of the 8 who had perfect scores were beyond the time standard of 8 minutes, only 5 pupils or 8.19% may be excused from further drill. Then in this room 34 out of 37, or 91.90% need corrective work in subtraction.

Table XIV shows that in Room 1 3 pupils attained a perfect score in time ranging from 5 to 8 minutes. The range in score was from 100% to 64%, and the range in time was from 4 to 19 minutes. The median score was 88%, and the median time was 6 minutes. The mean score was 86.85%, and the mean time was 7.44 minutes. Thus in Room 1 33 pupils out of 37, or 91.89% need corrective work in subtraction, 3 pupils or 8.34% are excused.

Table XII Showing distribution of Scores and Time made by pupils of Room L on initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 4	5	6	7	8	9	10	11	12	13	19	Totals	Percentage at each point
100			1		2							3	7.89
96			1	1			1					3	7.89
92		1			1				2			4	10.52
88			3				1					4	10.52
84	1	1					1					3	7.89
80					1		1					2	5.26
76					2				1			3	7.89
72								1				1	2.63
68			1		2	2						5	13.15
64			1								1	2	5.26
60			1									1	2.63
56								1				1	2.63
52										1		1	2.63
48													
44													
40				1								1	2.63
36										1		1	2.63
32													
28				1								1	2.63
24													
20													
16					1							1	2.63
12		1										1	2.63
	1	3	8	3	9	2	4	2	3	2	1	38	99.94

	Score	Time
Median	76%	8 Minutes
Q1	64%	6 "
Q3	92%	10 "
Mean	73.36%	8.44 Minutes

Pupils up to accuracy and time standards 3 or 7.89%

Table XII Showing distribution of Scores and Time made by pupils of Room L on initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	4	5	6	7	8	9	10	11	12	13	19	Totals	Percentage at each point
100			1		2							3	7.89
96			1	1			1					3	7.89
92		1			1				2			4	10.52
88			3				1					4	10.52
84	1	1					1					3	7.89
80					1		1					3	5.26
76					2				1			3	7.89
72								1				1	2.63
68			1		2	2						5	13.15
64			1								1	2	5.26
60			1									1	2.63
56								1				1	2.63
52										1		1	2.63
48													
44													
40				1								1	2.63
36										1		1	2.63
32													
28				1								1	2.63
24													
20													
16					1							1	2.63
12		1										1	2.63
	1	3	8	3	9	2	4	2	3	2	1	38	99.94

	Score	Time
Median	76%	8 Minutes
Q1	64%	6 "
Q3	92%	10 "
Mean	73.36%	8.44 Minutes

Pupils up to accuracy and time standards 3 or 7.89%

Table XIII Showing distribution of Scores and Time made by pupils of Room W on initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	4	5	6	7	8	9	10	13	14	15 & 16	Totals	Percentage at each point
100	1		1	1		2					5	13.50
96			1	6	2		1				10	27.00
92	1	1	2	4	2						10	27.00
88	1			1		1					3	8.10
84					1		1		1		3	8.10
80			1		1						2	5.40
76												
72										1	1	2.70
68								1			1	2.70
64												
60									1		1	2.70
56										1	1	2.70
	3	1	5	12	6	3	2	1	2	2	37	99.90

	Score	Time
Median	92%	7 Minutes
Q1	88%	6 "
Q3	96%	8 "
Mean	89.51%	8.05 Minutes

Pupils up to accuracy and time standards 3 or 8.10%

Table XIII

Showing distribution of Scores and Time made by pupils of Room Y on Initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES																Totals	Percentage at each point
in %	4	5	6	7	8	9	10	12	14	16	18							
100	1		1	1		2											5	13.80
96			1	6	2		1										10	27.00
92	1	1	2	4	2												10	27.00
88	1			1		1											3	8.10
84					1		1		1								3	8.10
80			1		1												2	5.40
76																		
72								1									1	2.70
68									1								1	2.70
64																		
60										1							1	2.70
56																		
	3	1	5	12	6	3	2	1	2	1	2	37						99.90

	Score	Time
Median	92%	7 Minutes
Q1	88%	6 "
Q3	96%	8 "
Mean	89.81%	8.05 Minutes

Pupils up to accuracy and time standards 3 or 8.10%

Table XIV Showing distribution of Scores and Time made by pupils of Room J on initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 4	5	6	7	8	9	10	12	14	18	Totals	Percentage at each point
100		1	2								3	8.34
96	2	1			1		2				6	16.68
92	1	1	1		1						4	11.12
88			5				1	1			7	19.46
84	1	1	1		1	1					5	13.90
80				1	1			1			3	8.34
76			1			1	1				3	8.34
72			1							1	2	5.56
68			1						1		2	5.56
64				1							1	2.78
	4	4	12	2	4	2	4	2	1	1	36	100.08

	Score	Time
Median	88%	6 Minutes
Q1	80%	6 "
Q3	92%	9 "
Mean	85.89%	7.44 Minutes

Pupils up to accuracy and time standards 3 or 8.34%

Table XV shows that in Room H 3 pupils attained perfect scores in time ranging from 5 to 11 minutes. The range in score was from 100% to 4 %, and the range in time was from 3 to 21 minutes. The median score was 92%, and the median time was 8 minutes. The mean score was 81.60% and the mean time was 7.94 minutes. Because 2 of the 3 pupils who had 100% were beyond the time standard of 8 minutes, only one pupil or 2.85% may be excused from further drill. Then in this room 34 out of 35 pupils, or 97.15% of the class need corrective work in subtraction.

Table XVI shows that in Room R 6 pupils attained a perfect score in time ranging from 4 to 7 minutes. The range in score was from 100% to 60%, and the range in time was from 4 to 16 minutes. The median score was 92% and the median time was 7 minutes. The mean score was 87.78%, and the mean time was 7.88 minutes. Thus in this room 30 out of 36 pupils, or 83.32% need corrective work insubtraction, 6 pupils or 16.68% are excused.

Table XVII is the summary table for Subtraction. It shows that out of 182 pupils tested, 20 attained a perfect score in time ranging from 4 to 11 minutes. The range in score was from 100% to 4%, and the range in time was from 3 to 21 minutes. The median score was 88% and the median time was 7 minutes. The mean score was 83.56% and the mean time was 7.81 minutes. Because 4 out of the 20 perfect scores were beyond the time standard of 8 minutes, only 16 or 8.80% are up to standard. Thus the corrective load in subtraction is 166 pupils or 91.20%.

Table XV shows that in Room B 5 pupils attained perfect scores in time ranging from 5 to 11 minutes. The range in score was from 100% to 4%, and the range in time was from 5 to 21 minutes. The median score was 92%, and the median time was 8 minutes. The mean score was 81.80% and the mean time was 7.94 minutes. Because 2 of the 5 pupils who had 100% were beyond the time standard of 8 minutes, only one pupil or 2.85% may be excused from further drill. Then in this room 34 out of 35 pupils, or 97.15% of the class need corrective work in subtraction.

Table XVI shows that in Room B 8 pupils attained a perfect score in time ranging from 4 to 7 minutes. The range in score was from 100% to 60%, and the range in time was from 4 to 16 minutes. The median score was 92% and the median time was 7 minutes. The mean score was 87.75%, and the mean time was 7.88 minutes. Thus in this room 30 out of 35 pupils, or 85.35% need corrective work insubtraction. 5 pupils or 14.88% are excused.

Table XVII in the summary table for Subtraction. It shows that out of 182 pupils tested, 30 attained a perfect score in time ranging from 4 to 11 minutes. The range in score was from 100% to 4%, and the range in time was from 5 to 21 minutes. The median score was 88% and the median time was 7 minutes. The mean score was 88.80% and the mean time was 7.81 minutes. Because 4 out of the 30 perfect scores were beyond the time standard of 8 minutes, only 16 or 8.80% are up to standard. Thus the corrective load in subtraction is 166 pupils or 91.20%.

Table XV Showing distribution of Scores and Time made by pupils of Room H on initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 3	4	5	6	7	8	9	11	12	14 to 21	Totals	Percentage at each point
100			1				1	1			3	8.55
96	1		1	4						1	7	19.95
92	1	1	1	2	1		2				8	22.80
88					1	2	1				4	11.40
84						1		1			2	5.70
80												
76							1		1		2	5.70
72							1	1			2	5.70
68				1							1	2.85
64												
60						1					1	2.85
56												
52								1	1		2	5.70
48	1									1	2	5.70
4						1					1	2.85
	3	1	3	7	2	5	7	4	1	2	35	99.75

	Score	Time
Median	92%	8 Minutes
Q1	72%	6 "
Q3	96%	9 "
Mean	81.60%	7.94 Minutes

Pupils up to accuracy and time standards 1 or 2.85%

Table XVI Showing distribution of Scores and Time made by pupils of Room R on initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES										
in %	4	5	6	7	8	9	10	11	13 to 16	Totals	Percentage at each point
100	2			4						6	16.68
96		1	1	3	1	1	1	1		9	25.02
92			1	2		1				4	11.12
88			1	2	1	1				5	13.90
84				1		1				2	5.56
80		1					1		2	4	11.12
76		1							1	2	5.56
72											
68											
64			1				1			2	5.56
60				1			1			2	5.56
	2	3	4	13	2	4	4	1	3	36	100.08

	Score	Time
Median	92%	7 Minutes
Q1	80%	6 "
Q3	96%	9 "
Mean	87.78%	7.88 Minutes

Pupils up to accuracy and time standards 6 or 16.68%

Table XVII Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J, H, R, on initial S. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 3	4	5	6	7	8	9	10	11	12 to 21	Total	Percentage at each point
100		3	2	4	5	2	3		1		20	11.00
96	1	2	3	7	10	4	1	5	1	1	35	19.25
92	1	3	4	6	7	4	3			2	30	16.50
88		1		9	4	3	3	2		1	23	12.65
84		2	2	1	1	3	2	2	1	1	15	8.25
80			1	1	1	3		2		3	11	6.05
76			1	1		2	2	1		3	10	5.50
72				1			1		2	2	6	3.30
68				3		2	2			2	9	4.95
64				2	1			1		1	5	2.75
60				1	1	1		1		1	5	2.75
56									1	1	2	1.10
52							1		1	1	3	1.65
48	1									1	2	1.10
40					1						1	.55
36										1	1	.55
28					1						1	.55
16						1					1	.55
12				1							1	.55
4						1					1	.55
0											0	
	3	11	13	37	33	26	18	14	7	20	182	100.10

	Score	Time
Median	88%	7 Minutes
Q1	76%	6 "
Q3	96%	9 "
Mean	83.56%	7.81 Minutes

Pupils up to accuracy and time standards 16 or 8.80%

(3) MULTIPLICATION.

Standards adopted.

Accuracy 100% Time 12 minutes.

Since the same method was followed for the other two processes, it will not be necessary to interpret each one in such explicit detail as has been done for addition and subtraction. Just the summary tables will be interpreted. Before this summary is made for multiplication it is interesting to note that experiments have proven that multiplication is the most used process in adult life. Furthermore it is interesting to note that the results obtained in this study are similar to those obtained by Hanley and Yarbrough in their studies.

Table XXIII shows the summary of results in multiplication for all the rooms. Out of the 187 pupils tested not one attained a perfect score. The highest score was 96% in 10 minutes. The range in scores was from 96% to 0%, and the range in time was from 6 to 34 minutes. The median score was 60% and the median time was 13 minutes. The mean score was 57.71% and the mean time was 13.73 minutes. Thus all the pupils in grade six or 100% need corrective work in multiplication.

(4) LONG DIVISION.

Standards Adopted.

Accuracy 100% Time 20 minutes.

The writer wishes to note here that the pupils taking this test in long division have had just one year of teaching in the process. The usual plan of teaching long division in the fourth grade was changed just the year previous to this study.

(3) MULTIPLICATION.

Standards adopted.

Accuracy 100% Time 12 minutes.

Since the same method was followed for the other two processes, it will not be necessary to interpret each one in such explicit detail as has been done for addition and subtraction. Just the summary tables will be interpreted. Before this summary is made for multiplication it is interesting to note that experiments have proven that multiplication is the most need process in adult life. Furthermore it is interesting to note that the results obtained in this study are similar to those obtained by Hanley and Yerbrough in their studies.

Table XXIII shows the summary of results in multiplication for all the rooms. Out of the 187 pupils tested not one attained a perfect score. The highest score was 95% in 10 minutes. The range in scores was from 95% to 0%, and the range in time was from 8 to 94 minutes. The median score was 80% and the median time was 15 minutes. The mean score was 67.7% and the mean time was 15.75 minutes. Thus all the pupils in grade six or 100% need corrective work in multiplication.

(4) LONG DIVISION.

Standards adopted.

Accuracy 100% Time 20 minutes.

The writer wishes to note here that the pupils taking this test in long division have had just one year of teaching in the process. The usual plan of teaching long division in the fourth grade was changed just the year previous to this study.

Table XVIII Showing distribution of Scores and Time made by pupils of Room L on initial M. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	8	9	10	11	12	13	14	15	16 to 20	21 to 31	Totals	Percentage at each point
100											0	
96											0	
92					1						1	2.56
88												
76					1			1	1		3	7.68
72	1					1					2	5.12
68			1	1					1		3	7.68
64							1		1		2	5.12
60			1								1	2.56
56						1			1		2	5.12
52	1								1		2	5.12
48				1			1	3	1	1	7	17.92
44	1			1					1		3	7.68
40										1	1	2.56
36							1		1		2	5.12
32					1						1	2.56
28									1	1	2	5.12
20									1		1	2.56
16									1		1	2.56
12										2	2	5.12
0		1							1	1	3	7.68
	3	1	2	3	3	2	3	4	12	6	39	99.84

	Score	Time
Median	48%	15 Minutes
Q1	32%	12 "
Q3	64%	19 "
Mean	46.15%	16.21 Minutes

Pupils up to accuracy and time standards 0

Boston University
School of Education
Library

Table XIX Showing distribution of Scores and Time made by pupils of Room W on initial M. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 7	9	10	11	12	13	14	15 to 19	20 to 26	34	Total	Percentage at each point
100											0	
92							1				1	2.63
88			1	1							2	5.26
84							1				1	2.63
80				1				1			2	5.26
76				1							1	2.63
72					1	1			1		3	7.89
68		1		1							2	5.26
64								1	1		2	5.26
60						1		1			2	5.26
56				1		2	1				4	10.52
52					1						1	2.63
48		1		1				1	1		4	10.52
44					1		1	4			6	15.78
40					1						1	2.63
36							1		1		2	5.26
28									1		1	2.63
16										1	1	2.63
8								1			1	2.63
4	1										1	2.63
	1	2	1	6	4	4	5	9	5	1	38	99.94

	Score	Time
Median	56%	14 Minutes
Q1	44%	11 "
Q3	72%	18 "
Mean	54.94%	14.92 Minutes

Pupils up to accuracy and time standards 0

Table XX Showing distribution of Scores and Time made by pupils of Room J on initial M. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	6	7	8	9	10	11	12	13	14	15 to 20	Totals	Percentage at each point
100											0	
92					1						1	2.78
88							1				1	2.78
84		1									1	2.78
80				2						1	3	8.34
76	1					1	2	2	1		7	19.46
72		1	1			1	1				4	11.12
68		1				1		1		1	4	11.12
64					1						1	2.78
60				2			1		1		4	11.12
56				1		1		1			3	8.34
52							1				1	2.78
48										2	2	5.56
36							1				1	2.78
28										1	1	2.78
24		1									1	2.78
4					1						1	2.78
	1	4	1	5	3	4	7	4	2	5	36	100.08

	Score	Time
Median	68%	11 Minutes
Q1	56%	9 "
Q3	76%	12 "
Mean	64.11	11.36 Minutes

Pupils up to accuracy and time standards 0

Table XXI Showing distribution of Scores and Time made by pupils of Room H on initial M. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	6	8	10	11	12	13	14	16 & 17	19	20 to 26	Total	Percentage at each point
100											0	
96			1								1	2.78
84			1								1	2.78
80			2					1			3	8.34
76		2	1				1			2	6	16.68
72							1				1	2.78
68		1						1	1		3	8.34
64								1		2	3	8.34
60					1	2	1			1	5	13.90
52										1	1	2.56
48			1		1			1		1	4	11.12
44				2		1					3	8.34
40						1					1	2.78
28										1	1	2.78
24			1						1		2	5.56
0	1										1	2.78
	1	3	7	2	2	4	3	4	2	8	36	99.84

	Score	Time
Median	60%	13 Minutes
Q1	48%	10 "
Q3	76%	19 "
Mean	59.33%	14.86 Minutes

Pupils up to accuracy and time standards 0

Table XXII Showing distribution of Scores and Time made by pupils of Room R on initial M. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 7	8	9	10	11	12	13	14	15 to 21	Total	Percentage at each point
100										0	
92		1	1				1		1	4	10.52
88			1			1				2	5.26
84				1			2		2	5	13.15
80				1		1	1			3	7.89
76			1					1		2	5.26
72			1			1	1	1		4	10.52
68							2		2	4	10.52
64				2			2			4	10.52
60	1				1				1	3	7.89
56				2						2	5.26
52			1		1					2	5.26
44							1			1	2.63
36							1			1	2.63
16							1			1	2.63
	1	1	5	6	2	3	12	2	6	38	99.94

	Score	Time
Median	72%	13 Minutes
Q1	60%	10 "
Q3	84%	13 "
Mean	70.10%	12.26 Minutes

Pupils up to accuracy and time standards 0

Table XXII Showing distribution of Scores and Time made by pupils of Room 2 on Unit Test A. P. Test given in October. Scores are given in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES															
In %	7	8	9	10	11	12	13	14	15 to 21	Total	Percentage at each point
100										0	
92		1	1				1		1	4	10.52
88			1			1				2	5.26
84				1			2		2	5	12.15
80				1		1	1			3	7.89
76			1					1		2	5.26
72			1			1	1	1		4	10.52
68							2		2	4	10.52
64				2			2			4	10.52
60	1				1				1	3	7.89
56				2						2	5.26
52			1		1					2	5.26
44							1			1	2.63
36							1			1	2.63
16							1			1	2.63
	1	1	5	6	2	3	12	3	6	38	99.94

	Score	Time
Median	72%	13 Minutes
Q1	60%	10 "
Q3	84%	15 "
Mean	70.10%	12.80 Minutes

Pupils up to accuracy and time standards 0

Table XXIII Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J, H, R, on initial M. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 6 to 8	9	10	11	12	13	14	15	16 to 20	21 to 34	Totals	Percentage at each point
100											0	
96			1								1	.54
92	1	1	1		1	1	1			1	7	3.78
88		1	1	1	2						5	2.70
84	1		2			2	1		2		8	4.32
80		2	3	1	1	1		2	1		11	5.94
76	3	1	1	2	3	3	2	1	2	1	19	10.26
72	3	1		1	3	3	2			1	14	7.56
68	2	1	1	3		3		1	5		16	8.64
64			3			2	1		3	3	12	6.48
60	1	2		2	2	3	2		2	1	15	8.10
56		1	2	2		4	1		1		11	5.94
52		2		1	2				2		7	3.78
48		1	1	2	1		1	3	6	2	17	9.18
44	1			3	1	2	1	1	4		13	7.02
40					1	1				1	3	1.62
36					1	1	2		2		6	3.24
32					1						1	.54
28									2	3	5	2.70
24	1			1					1		3	1.62
20									1		1	.54
16						1			1	1	3	1.62
12										2	2	1.08
8									1		1	.54
4	1		1								2	1.08
0	1	1							1	1	4	2.16
	15	14	17	19	19	27	14	8	37	17	187	100.98

	Score	Time
Median	60%	13 Minutes
Q1	48%	11 "
Q3	76%	16 "
Mean	57.71%	13.73 Minutes

Pupils up to accuracy and time standards 0

Table XXIV Showing distribution of Scores and Time made by pupils of Room L on initial L. D. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	16	18	19	23 & 24	25	26	27	28	30 to 40	41 to 56	Totals	Percentage at each point
100												
96	1										1	2.78
88				2			1		1		4	11.12
76			1				1				2	5.56
72									2		2	5.56
68					1			1	1	1	4	11.12
64						1			2	1	4	11.12
60									1		1	2.78
56									2		2	5.56
48		1							1		2	5.56
44								1		1	2	5.56
40										1	1	2.78
36									1		1	2.78
32									1		1	2.78
28										1	1	2.78
20									1		1	2.78
12	1				1						2	5.56
4									1		1	2.78
0			1		1		1		1		4	11.12
	2	1	2	2	3	1	3	2	15	5	36	100.08

	Score	Time
Median	56%	30 Minutes
Q1	28%	25 "
Q3	68%	35 "
Mean	50.61%	30.88 Minutes

Pupils up to accuracy and time standards 0

Table XXV Showing distribution of Scores and Time made by pupils of Room W on initial L. D. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	15	16	17	18	20	21 & 22	23 & 24	25 to 30	31 to 38	40 to 68	Total	Percentage at each point
100												
96												
92	1		1			1	1		1		5	12.80
88	1	2		1		1			1		6	15.36
80		1		1			1		1		4	10.24
76							1				1	2.56
72		1									1	2.56
68					2		1	1		2	6	15.36
60							1	1		1	3	7.68
56								1			1	2.56
48									1	1	2	5.12
40						2					2	5.12
36										1	1	2.56
32								1			1	2.56
16								1			1	2.56
12									1		1	2.56
8									2		2	5.12
0							1		1		2	5.12
	2	4	1	2	2	4	6	5	8	5	39	99.78

	Score	Time
Median	68%	24 Minutes
Q1	40%	20 "
Q3	88%	33 "
Mean	61.64%	28.15 Minutes

Pupils up to accuracy and time standards 0

Table XXVI Showing distribution of Scores and Time made by pupils of Room J on initial L. D. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	7 to 10	11	13	14	15	16	17	18 & 19	20 to 29	30 & 35	Total	Percentage at each point
100	3										3	8.34
96			2						1		3	8.34
92	1			1		1					3	8.34
88	1	1			1		1		1	1	6	16.68
84		1	1	1		1		2	2		8	22.24
80	1						1	1			3	8.34
72			1			2					3	8.34
68					1					1	2	5.56
64						1					1	2.78
60								1			1	2.78
52									1		1	2.78
48								1			1	2.78
40									1		1	2.78
8												
4												
0												
	6	2	4	2	2	5	2	5	6	2	36	100.08

	Score	Time
Median	84%	16 Minutes
Q1	72%	13 "
Q3	88%	19 "
Mean	81.11%	16.66 Minutes

Pupils up to accuracy and time standards 3 or 8.34%

Table XXVI

Showing distribution of Scores and Time made by pupils of Room 4 on Initial D. F. Test given in October. Scores are given in per cents at the left, and time in minutes is shown at the top.

| SCORES | TIME IN MINUTES | | |

Table XXVII Showing distribution of Scores and Time made by pupils of Room H on initial L. D. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES										
in %	15 to 20	21	22	23	24	25	26 to 30	35 to 40	41 to 50	Total	Percentage at each point
100		1								1	2.73
96	2									2	5.46
88				2		1	2		1	6	16.38
84					1		1			2	5.46
80	2					1		1		4	10.92
76	1		1					2	1	5	13.65
72	1							1		2	5.46
68	1			1	1					3	8.19
64			1				2			3	8.19
60									1	1	2.73
56									1	1	2.73
48					1				1	2	5.46
40					1					1	2.73
16									2	2	5.46
12									1	1	2.73
0	1									1	2.73
	8	1	2	3	4	2	5	4	8	37	101.01

	Score	Time
Median	76%	25 Minutes
Q1	60%	21 "
Q3	84%	35 "
Mean	69.51%	29.88 Minutes

Pupils up to accuracy and time standards 0

Table XXVII Showing distribution of Scores and Time marks by pupils of Room F on Initial I. E. T. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

| Scores | TIME IN MINUTES | | |

Table XXVIII Showing distribution of Scores and Time made by pupils of Room R on initial L. D. P. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	12 to 18	19	20	21	22	23	24	25 to 30	31 to 40	41 to 50	Total	Percentage at each point
100	2										2	5.12
96		1									1	2.56
92	2			1							3	7.68
88	1	1							1		3	7.68
84	2					1		2	1	2	8	20.48
80	1		1	1	1			1	1		6	15.36
76		2					1				3	7.68
72								1	1		2	5.12
68								1	1		2	5.12
64										1	1	2.56
60										1	1	2.56
56						1				1	2	5.12
52							1	1			2	5.12
48			1								1	2.56
28										1	1	2.56
12			1								1	2.56
0											0	
	8	4	3	2	1	2	2	6	5	6	39	99.92

	Score	Time
Median	80%	23 Minutes
Q1	68%	19 "
Q3	84%	34 "
Mean	67.54	25.54 Minuts

Pupils up to accuracy and time standards 2 or 5.12%

Table XXVIII. Showing distribution of Scores and Time made by pupils of Room B on Initial E. D. F. Test given in October. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORE	TIME IN MINUTES												
In %	18 to 19	19	20	21	22	23	24	28 to 30	31 to 40	41 to 60	Total	Percentage at each point
100	2									2	2	5.12
96		1								1	1	2.56
92	2			1						3	3	7.68
88	1	1						1		3	3	7.68
84	2					1		2	1	2	8	20.48
80	1		1	1	1			1	1	3	8	20.48
76		2					1			3	3	7.68
72								1	1	2	2	5.12
68								1	1	2	2	5.12
64									1	1	1	2.56
60									1	1	1	2.56
56						1			1	2	2	5.12
52							1	1		2	2	5.12
48			1							1	1	2.56
28									1	1	1	2.56
12			1							1	1	2.56
0										0		
	8	4	5	2	1	1	1	5	5	39	39	99.92

Median	Score	Time
	80%	25 Minutes
Q1	68%	19 "
Q3	84%	36 "

Mean 67.64 28.64 Minutes

Pupils up to accuracy and time standards 8 or 8.12%

Table XXIX Summary Table - Showing distribution of Scores made by pupils October. Scores are shown in per cents at the left, and time

SCORES in %	TIME IN MINUTES												
	7 to 10	11	12	13	14	15	16	17	18	19	20	21	22
100	3		1				1					1	
96				2		1	1		1	1			1
92	1		1		1	1	1	1	1			2	
88	1	1	1			2	2	1	1	1			1
84		1		1	1		1	1	1	2	2		
80	1					2	1	1	1		3	1	1
76										3	1		1
72				1			2	1			1		
68						1					3		
64								1					1
60									1				
56													
52													
48									1	1	1		
44													
40												1	1
36													
32													
28													
20													
16													
12							1				1		
8													
4													
0										1	1		
	6	2	3	4	2	7	10	6	7	9	13	5	6

Score

Median	76%
Q1	56%
Q3	84%

Mean 66.46%

Pupils up to accuracy and time stan

of Rooms L, W, J, H, and R, on initial L. D. P. Tests given in

in minutes is shown at the top.

23	24	25	26 to 35	36 to 45	46 to 55	56 to 68	Total	Percentage at each point
							6	3.24
							7	3.78
1			1				11	5.94
3	1	2	6	2			25	13.50
1	1		4	1	1		18	9.36
	1	1	4				17	9.18
1	1		2	1	1		11	5.94
			4	1			10	5.40
1	2	2	4	3		1	17	9.18
			5	2			9	4.86
1			1	2	1	1	7	3.78
1		1	2	1	1		6	3.24
	1		2				3	1.62
	1		2		1	1	8	4.32
			1			1	2	1.08
1	1				1		5	2.70
			1	1			2	1.08
			1		1		2	1.08
				2			2	1.08
				1			1	.54
			1		2		3	1.62
		1		1	1		5	2.70
				2			2	1.08
				1			1	.54
	1	1	2	1			7	3.78
10	10	8	43	22	10	4	187	100.62

Time

24 Minutes
19 "
33 "

26.36 Minutes

dards 5 or 2.70%

This is in conformity with recent trends in teaching arithmetic and shows that this city is progressive and trying to keep up with the best in educational method. It is also interesting to note that all the perfect scores were in one building. This may imply that better teaching had been done by some fifth grade teachers.

Table XXIX is the summary table for long division. It shows that 6 pupils out of 187 attained a perfect score in time ranging from 7 to 21 minutes. The range in scores was from 100% to 0%, and the range in time was from 7 to 68 minutes. The median score was 76% and the median time was 24 minutes. The mean score was 66.46% and the mean time was 26.36 minutes. Thus 182 pupils out of 187, or 97.30% need corrective work in long division. One pupil did not reach the time standard of 20 minutes so he is included in the corrective group. Then 5 pupils or 2.70% could be excused.

5. SUMMARY: THE CORRECTIVE LOAD DETERMINED.

From these tabulated results it will be seen that there is a great need for corrective work to be done in each process. In addition 174 out of 185 need corrective work; in subtraction 166 out of 182 need corrective work; in multiplication 187 out of 187 need corrective work; and in long division 182 out of 187 need corrective work. Table XXX shows the summary of these facts. It shows the number tested in each process, the number needing corrective work, and the percentage of pupils needing corrective work at the sixth grade level in this district.

This is in conformity with recent trends in teaching arithmetic and shows that this city is progressive and trying to keep up with the best in educational method. It is also interesting to note that all the perfect scores were in one building. This may imply that better teaching had been done by some fifth grade teachers.

Table XXIX is the summary table for long division. It shows that 6 pupils out of 187 attained a perfect score in time ranging from 7 to 21 minutes. The range in scores was from 100% to 0%, and the range in time was from 7 to 38 minutes. The median score was 76% and the median time was 24 minutes. The mean score was 66.49% and the mean time was 26.38 minutes. Thus 182 pupils out of 187, or 97.80% need corrective work in long division. One pupil did not reach the time standard of 20 minutes so he is included in the corrective group. Then 5 pupils or 2.70% could be excused.

5. SUMMARY: THE CORRECTIVE LOAD DETERMINED.

From these tabulated results it will be seen that there is a great need for corrective work to be done in each process. In addition 174 out of 188 need corrective work; in subtraction 186 out of 182 need corrective work; in multiplication 187 out of 187 need corrective work; and in long division 182 out of 187 need corrective work. Table XXX shows the summary of these facts. It shows the number tested in each process, the number needing corrective work, and the percentage of pupils needing corrective work at the sixth grade level in this district.

Table XXX SHOWING THE CORRECTIVE LOAD AS DETERMINED FOR ALL THE SIXTH GRADES IN THIS DISTRICT, IN THE FOUR FUNDAMENTAL PROCESSES IN ARITHMETIC, DATA BEING OBTAINED FROM THE INITIAL TESTS GIVEN IN OCT. 1938

	AP	SP	MP	LDP	TOTALS
Pupils tested	185	182	187	187	741
Pupils needing corrective work	174	166	187	182	709
Pupils excused from drill	11	16	0	5	32
Percentage of pupils needing corrective work	94.06%	91.20%	100%	97.30%	95.68%
Percentage of pupils excused from drill	5.94%	8.80%	0%	2.70%	4.32%

Note: The variation shown in the number tested is due to the fact that on the day of each separate test some pupils were absent.

Table XXX

SHOWING THE CORRECTIVE IDAD AS DETERMINED FOR ALL
THE SIXTH GRADES IN THIS DISTRICT, IN THE FOUR
FUNDAMENTAL PROCESSES IN ARITHMETIC, DATA BEING
OBTAINED FROM THE INITIAL TESTS GIVEN IN OCT. 1923

	AP	SP	MP	DP	TOTALS
Pupils tested	185	182	187	187	741
Pupils needing corrective work	174	166	187	182	709
Pupils excused from drill	11	16	0	5	32
Percentage of pupils needing corrective work	94.06%	91.20%	100%	97.30%	95.68%
Percentage of pupils excused from drill	5.94%	8.80%	0%	2.70%	4.32%

Note: The variation shown in the number tested is due to the fact that on the day of each separate test some pupils were absent.

CHAPTER III ACQUAINTING COOPERATING TEACHERS WITH RESULTS OF INITIAL TEST.

1. WAYS IN WHICH CONTACTS WERE MADE.

(a) PERSONAL CONVERSATIONS.

(b) WRITTEN SUGGESTIONS IN THE FORM OF EXHIBITS.

EX.2. ANALYSIS AND FREQUENCY OF ERRORS MADE IN A.P. TEST.

EX.3. SUGGESTIONS FOR CORRECTIVE WORK IN ADDITION.

EX.4. ANALSIS AND FREQUENCY OF ERRORS MADE IN S.P. TEST.

EX.5. SUGGESTIONS FOR CORRECTIVE WORK IN SUBTRACTION.

EX.6. ANALSIS AND FREQUENCY OF ERRORS MADE IN M.P. TEST.

EX.7. SUGGESTIONS FOR CORRECTIVE WORK IN MULTIPLICATION.

EX.8. SUGGESTIONS FOR CORRECTIVE WORK IN LONG DIVISION.

2. AN ENLARGED OPPORTUNITY.

A TALK GIVEN AT A GENERAL TEACHERS' MEETING OF THE DISTRICT.

CHAPTER III. ACQUAINTING COOPERATING TEACHERS WITH THE RESULTS.

1. WAYS IN WHICH CONTACTS WERE MADE.

After the corrective load had been determined, the next step was to get the facts before the cooperating teachers. This was done in several ways. First, personal conversations and conferences were held whenever opportunity favored. Sometimes these were held before school, at recess time or after school.

(a)PERSONAL CONVERSATIONS.

The writer was fortunate in being able to see very often three of the four teachers who cooperated. One of the teachers from the other building ate lunch with the writer so she was included in the discussions and then relayed the important details to the other teacher in her building. The two teachers in the same building with the writer talked over plans and results very frankly.

(b)WRITTEN SUGGESTIONS.

The written suggestions were sent by the writer whenever the need was greatest. Immediately after the Initial A. P. TEST was corrected they were returned to the several teachers with the first set of suggestions. These suggestions were very definitely stated for conciseness so that they might be clearly understood. They are self-explanatory. (See Exhibits 3 - 5 - 7 and 8.)

In March after the Re-tests had been corrected, both sets of tests were returned so that the pupils could see the

CHAPTER III. ACQUAINTING COOPERATING TEACHERS WITH THE RESULTS.

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The written suggestions were sent by the writer whenever the need was greatest. Immediately after the Initial A. P. TEST was corrected they were returned to the several teachers with the first set of suggestions. These suggestions were very definitely stated for conciseness so that they might be clearly understood. They are self-explanatory. (See Exhibits 3 - 5 - 7 and 8.)

In March after the Re-tests had been corrected, both sets of tests were returned so that the pupils could see the

improvement which they had made, if any, and so that they could also determine the errors that still persisted.

improvement which they had made, if any, and so that they could also determine the errors that still persisted.

EXHIBIT 2 ANALYSIS OF A. P. TEST.

PROCESS STEP DIFFICULTIES	EXAMPLES.
1. Primary Facts Carrying Column Addition Zero	a b c d e
2. Two Columns No Carrying	f g h
3. Dangling Ends No Carrying Zero	i j k
4. Three Addends Carrying	l m n o
5. Five Addends Two Columns Zero Carrying	p q r s
6. Five Addends Three Columns Spaces Zero Carrying Money $.	t u w y
7. Six Addends Four Columns Zero Carrying Money $.	v
8. Seven Addends Four Columns Zero Carrying Money $.	x

(Continued on next page.)

EXHIBIT 2 ANALYSIS OF A. P. TEST.

PROCESS STEP DIFFICULTIES	EXAMPLES.
1. Primary Facts Carrying Column Addition Zero	a b c d e
2. Two Columns No Carrying	f g h
3. Dangling Ends No Carrying Zero	i j k
4. Three Addends Carrying	l m n o
5. Five Addends Two Columns Zero Carrying	p q r s
6. Five Addends Three Columns Spaces Zero Carrying Money $.	t u w y
7. Six Addends Four Columns Zero Carrying Money $.	v
8. Seven Addends Four Columns Zero Carrying Money $.	x

(Continued on next page.)

EXHIBIT 2 (CONT.) FREQUENCY OF ERRORS ON A. P. TEST.

EXAMPLES	ERRORS	
a	18	From this analysis the following
b	13	examples had 40 or more errors:
c	13	o, p, q, t, u, v, w, x and y. The example
d	7	with the most errors (x with 122) included
e	5	these difficulties; 7 addends, 4 columns,
f	9	zero, carrying and money.
g	14	As a result of this analysis the
h	8	following suggestions were given to work on;
i	3	limit the addends to five; limit columns to
j	2	five, but lead up to this as the maximum
k	11	from two, three and four columns; simplify
l	20	work at first and do not include too many
m	15	process step difficulties.
n	24	
o	40	The word "error" in this Exhibit
p	49	means that the example was done incorrectly
q	45	by a pupil so that the answer was incorrect.
r	38	The total number (822) means that out of
s	36	4625 chances to do examples incorrectly
t	43	only 822 or 17.77% of the examples done
u	75	were incorrect.
v	88	
w	59	
x	122	
y	65	822

EXHIBIT S (CONT.) FREQUENCY OF ERRORS ON A. P. TEST.

EXAMPLES	ERRORS	From this analysis the following
a	18	examples had 40 or more errors:
b	18	o, p, q, t, u, v, w, x and y. The example
c	13	with the most errors (x with 122) included
d	7	these difficulties; 7 addends, 4 columns,
e	5	zero, carrying and money.
f	9	
g	14	As a result of this analysis the
h	8	following suggestions were given to work on;
i	3	limit the addends to five; limit columns to
j	2	five, but lead up to this as the maximum
k	11	from two, three and four columns; simplify
l	20	work at first and do not include too many
m	15	process step difficulties.
n	24	
o	40	The word "error" in this Exhibit
p	49	means that the example was done incorrectly
q	45	by a pupil so that the answer was incorrect.
r	38	The total number (822) means that out of
s	36	4625 chances to do examples incorrectly
t	45	only 822 or 17.77% of the examples done
u	75	were incorrect.
v	88	
w	39	
x	122	
y	85	822

The preceding analysis showed how often each example on the test was done incorrectly. It showed the type of example the pupils failed on most frequently. This showed on which type of example they needed to drill most. It also gave the teacher an idea of the difficulties which were included in each example.

From this analysis, the suggestion was made to the cooperating teachers that more drill is needed on the fundamental facts. If these were known correctly, no errors would have occurred in the first four groups of examples up to example k. As the process step difficulties are added the possibilities of error increase. This is shown by the large number of errors in examples t - y. Increasing the number of addends by even one number increases the errors made, too. Therefore this fact should influence the size of the examples we as teachers should expect a sixth grade pupil to do correctly. An example limited to five addends was recommended throughout this study by the writer as a result of this analysis.

The preceding analysis showed how often each example on the test was done incorrectly. It showed the type of example the pupils failed on most frequently. This showed on which type of example they needed to drill most. It also gave the teacher an idea of the difficulties which were included in each example.

From this analysis, the suggestion was made to the cooperating teachers that more drill is needed on the fundamental facts. If these were known correctly, no errors would have occurred in the first four groups of examples up to example k. As the process step difficulties are added the possibilities of error increase. This is shown by the large number of errors in examples t - y. Increasing the number of addends by even one number increases the errors made, too. Therefore this fact should influence the size of the examples we as teachers should expect a sixth grade pupil to do correctly. An example limited to five addends was recommended throughout this study by the writer as a result of this analysis.

CHART I CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL A. P. TEST IN OCTOBER.

SCORE	ROOMS					
In %	L	W	J	H	R	TOTAL
100	1	4	3	7	5	20
96	2	4	5	3	7	21
92	2	1	9	6	8	26
88	4	8	4	4	2	22
84	2	4	3	5	3	16
80	3	4	2	4	3	16
76	7	5	3	4	3	22
72	2	3	2	1	6	14
68	4	1	0	1	1	7
64	3	1	0	1	0	5
60	3	1	1	0	0	5
56	1	1	1	0	0	3
52	1	1	0	0	0	2
48	2	1	0	0	0	3
44	0	0	0	1	0	1
40	1	0	0	0	0	1
36	0	0	0	0	0	0
32	1	0	0	0	0	1
28	0	0	0	0	0	0
24	0	0	0	0	0	0
20	0	0	0	0	0	0
16	0	0	0	0	0	0
12	0	0	0	0	0	0
8	0	0	0	0	0	0
4	0	0	0	0	0	0
0	0	0	0	0	0	0
TOTALS	39	38	33	37	38	185

MEDIAN SCORE 84% TIME 10 Minutes

MEAN SCORE 82.59% TIME 10.34 Minutes

CHART I CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL A. P. TEST IN OCTOBER.

SCORE	ROOMS					
In %	L	W	J	H	S	TOTAL
100	1	4	3	7	5	20
96	2	4	5	3	7	21
92	2	1	9	6	8	26
88	4	8	4	4	2	22
84	2	4	3	5	3	16
80	3	4	2	4	3	16
76	7	3	3	4	3	22
72	2	3	2	1	6	14
68	4	1	0	1	1	7
64	3	1	0	1	0	5
60	3	1	1	0	0	5
56	1	1	1	0	0	3
52	1	1	0	0	0	2
48	2	1	0	0	0	3
44	0	0	0	1	0	1
40	1	0	0	0	0	1
36	0	0	0	0	0	0
32	1	0	0	0	0	1
28	0	0	0	0	0	0
24	0	0	0	0	0	0
20	0	0	0	0	0	0
16	0	0	0	0	0	0
12	0	0	0	0	0	0
8	0	0	0	0	0	0
4	0	0	0	0	0	0
0	0	0	0	0	0	0
TOTALS	39	38	33	37	38	185

MEDIAN SCORE 84% TIME 10 Minutes

MEAN SCORE 82.59% TIME 10.34 Minutes

EXHIBIT 3 WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN ADDITION

PRELIMINARY SUGGESTIONS

1. Return tests to pupils to find out their own errors.
2. Put this list of errors on the blackboard to help them to find out their own errors.

ERRORS MADE IN ADDITION

1. Counted in some form.
2. Did not know primary facts, (1+1 to 10+10 etc.).
3. Did not know upper decade facts,(11+1, 21+1, 31+1 to 39+9).
4. Forgot to carry.
5. Carried wrong number.
6. Omitted decimal point.
7. Put decimal point in wrong place.

3. Call attention to poor work habits.
   a. Figures poorly and carelessly made.
   b. Marking over an incorrect figure, instead of crossing it out and re-writing it.

      8   8
      7

   c. Overlooking or omitting entirely
      one example
      one row of examples.
   d. Omitting dollar sign.
4. Collect tests and return to writer.

SUGGESTIONS.

1. Have each pupil make a list of his own errors, using list from board as a help.
2. Have each pupil card the facts on which he failed.

OBVERSE SIDE	REVERSE SIDE
5 8 13	5 8

Use the small cards for flash cards and for individual daily drill.

Do the same for the upper decade facts on which he failed.

3. Plan to spend 20 minutes a day for 3 days a week on corrective work in addition.
4. Plan to give FIVE written examples a day in addition. Include the following types:
   a. 3 figure- 3 addends with carrying.
   b. 3 figure- 5 addends with spaces, zeros and carrying.
   c. 2 figure- 5 addends with carrying.
   d. 4 figure- 5 addends with carrying involving dollars and cents.
   e. 2 figure- 4 addends with carrying.
5. Use flash cards daily for quick drill. Response must be automatic. No counting should be allowed. Pupils should also use their individual sets drilling on their errors.

SUGGESTIONS.

1. Have each pupil make a list of his own errors, using list from board as a help.

2. Have each pupil card the facts on which he failed.

OBVERSE SIDE

$$\begin{array}{r} 6 \\ 8 \\ \hline 13 \end{array}$$

REVERSE SIDE

$$\begin{array}{r} 5 \\ 8 \\ \hline \end{array}$$

Use the small cards for flash cards and for individual daily drill.

Do the same for the upper decade facts on which he failed.

3. Plan to spend 20 minutes a day for 3 days a week on corrective work in addition.

4. Plan to give FIVE written examples a day in addition. Include the following types:

a. 3 figure- 3 addends with carrying.

b. 3 figure- 3 addends with spaces, zeros and carrying.

c. 3 figure- 3 addends with carrying.

d. 4 figure- 3 addends with carrying involving dollars and cents.

e. 2 figure- 4 addends with carrying.

5. Use flash cards daily for quick drill. Responses must be automatic. No counting should be allowed. Pupils should also use their individual cards drilling on their errors.

6. Limit the drill load.

   Make the pupils realize that in addition there are:

   100 primary facts.

   300 upper decade facts.

   80 facts for carrying in multiplication.

   480 facts that need to be known.

   Impress on their minds that once these facts are learned, they will have finished the job because these facts never will change.

7. Organize material into small working units.

   Divide class into small groups. Use pupils who attained a perfect score as leaders of these groups.

   Drill on primary facts.

   Drill on upper decade facts.

   Drill on column addition.

   Drill on two column addition, stressing carrying.

   Drill on examples involving money to fix use of dollar sign and decimal point.

8. AIM for ACCURACY and SPEED.

9. Teach CHECKING.

   Simple method suggested.

6. Limit the drill load.

Make the pupils realize that in addition there are:

100 primary facts.

300 upper decade facts.

80 facts for carrying in multiplication.

480 facts that need to be known.

Impress on their minds that once these facts are learned, they will have finished the job because these facts never will change.

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Drill on primary facts.

Drill on upper decade facts.

Drill on column addition.

Drill on two column addition, stressing carrying.

Drill on examples involving money to fix use of dollar sign and decimal point.

8. AIM for ACCURACY and SPEED.

9. Teach CHECKING.

Simple method suggested.

Working the example.

1. Start at the bottom of the column to add.
   ADD UP.
2. In carrying, add in the carried number FIRST.
3. Write the sum of each column, including the number which was carried, at the right of the example.

ILLUSTRATION

462	Check
359	24 ✓
876	31 ✓
490	31 ✓
927	-----
3114	

4. ADD DOWN, and see if numbers at the side agree.

10. Keep accurate records of work done each day.
    Suggestion: Use graph to show individual progress.
    Each child can be taught to make his own.
    (See Chapter IV Exhibits 10-12-13)

Working the example.

1. Start at the bottom of the column to add.

   ADD UP.

2. In carrying, add in the carried number FIRST.

3. Write the sum of each column, including the number which was carried, at the right of the example.

ILLUSTRATION

482	
389	Check
276	24 ✓
490	21 ✓
987	31 ✓
---	---
3114	

4. ADD DOWN, and see if numbers at the side agree.

10. Keep accurate records of work done each day.

Suggestion: Use graph to show individual progress.

Each child can be taught to make his own.

(See Chapter IV Exhibits 10-12-13)

EXHIBIT 4 ANALYSIS OF S. P. TEST.

PROCESS STEP DIFFICULTIES	EXAMPLES
1. Primary facts	a b
2. No borrowing	c g
3. Borrowing once	e f i k q v
Borrowing twice	h j l m n o
	p r x
Borrowing three times	d s t u w y
4. Zero difficulty	
In minuend	i n p q s u
	v w x y
In subtrahend	f g i l q
	s x
5. Dollars and cents	u v w x y
6. Dangling ends or spaces	d e g j k
	q r s t y

From this analysis it can be seen that one example often involves several difficulties.

(Continued on next page.)

EXHIBIT 4 ANALYSIS OF S. P. TEST.

PROCESS STEP DIFFICULTIES	EXAMPLES
1. Primary facts	a b
2. No borrowing	c g
3. Borrowing once	e f i k p v
Borrowing twice	h j l m r o
	p r x
Borrowing three times	d s t u w y
4. Zero difficulty	
In minuend	i n p q s u
	v w x y
In subtrahend	f g l l q
	s x
5. Dollars and cents	n v w x y
6. Dangling ends or spaces	d e g j k
	q r s t y

From this analysis it can be seen that one example often involves several difficulties.

(Continued on next page.)

EXHIBIT 4 (CONT.) FREQUENCY OF ERRORS MADE IN S. P. TEST.

EXAMPLES	ERRORS
a	15
b	21
c	15
d	40
e	16
f	32
g	6
h	25
i	33
j	34
k	44
l	32
m	27
n	42
o	45
p	33
q	18
r	24
s	51
t	36
u	44
v	29
w	37
x	48
y	65

From this analysis the following examples had 40 or more errors: d, n, o, s, u, x and y. The example with the most errors (y with 65) included these difficulties; dollars and cents, two zeros in the minuend, borrowing three times, dangling ends, and a zero in the answer.

As a result of this analysis the following suggestions were given to work on; examples with borrowing two or three times, with zero difficulty, with dangling ends, and involving money should be used in daily practice period.

EXHIBIT 4 (CONT.) FREQUENCY OF ERRORS MADE IN S. P. TEST.

EXAMPLES	ERRORS
a	15
b	21
c	15
d	40
e	10
f	32
g	6
h	25
i	38
j	34
k	44
l	38
m	27
n	42
o	46
p	33
q	18
r	24
s	31
t	36
u	44
v	29
w	37
x	43
y	65

From this analysis the following examples had 40 or more errors: d, p, o, s, u, x and y. The example with the most errors (y with 65) included three difficulties; dollars and cents, two zeros in the minuend, borrowing three times, dangling ends, and a zero in the answer.

As a result of this analysis the following suggestions were given to work on; examples with borrowing two or three times, with zero difficulty, with dangling ends, and involving money should be used in daily practice period.

CHART II CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL S. P. TEST IN OCTOBER.

SCORE	ROOMS					
In %	L	W	J	H	R	TOTAL
100	3	5	3	3	6	20
96	3	10	6	7	9	35
92	4	10	4	8	4	30
88	4	3	7	4	5	23
84	3	3	5	2	2	15
80	2	2	3	0	4	11
76	3	0	3	2	2	10
72	1	1	2	2	0	6
68	5	1	2	1	0	9
64	2	0	1	0	2	5
60	1	1	0	1	2	5
56	1	1	0	0	0	2
52	1	0	0	2	0	3
48	0	0	0	2	0	2
44	0	0	0	0	0	0
40	1	0	0	0	0	1
36	1	0	0	0	0	1
32	0	0	0	0	0	0
28	1	0	0	0	0	1
24	0	0	0	0	0	0
20	0	0	0	0	0	0
16	1	0	0	0	0	1
12	1	0	0	0	0	1
8	0	0	0	0	0	0
4	0	0	0	1	0	1
0	0	0	0	0	0	0
TOTALS	38	37	36	35	36	182

MEDIAN SCORE 88% TIME 7 Minutes.

MEAN SCORE 83.56% TIME 7.81 Minutes.

CHART II CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL S. P. TEST IN OCTOBER.

SCORE In %	ROOMS L	W	J	H	R	TOTAL
100	3	5	3	3	6	20
96	3	10	6	7	9	35
92	4	10	4	8	4	30
88	4	3	7	4	5	23
84	3	3	5	2	2	15
80	2	2	3	0	4	11
76	2	0	3	2	2	10
72	1	1	2	1	0	6
68	2	1	2	1	0	9
64	2	0	1	0	2	5
60	1	1	0	1	2	5
56	1	1	0	0	0	2
52	1	0	0	2	0	3
48	0	0	0	2	0	2
44	0	0	0	0	0	0
40	1	0	0	0	0	1
36	1	0	0	0	0	1
32	0	0	0	0	0	0
28	1	0	0	0	0	1
24	0	0	0	0	0	0
20	0	0	0	0	0	0
16	1	0	0	0	0	1
12	1	0	0	0	0	1
8	0	0	0	0	0	0
4	0	0	0	1	0	1
0	0	0	0	0	0	0
TOTALS	36	37	36	35	36	182

MEDIAN SCORE 88% TIME 7 Minutes.

MEAN SCORE 85.56% TIME 7.81 Minutes.

EXHIBIT 5 WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN SUBTRACTION

PRELIMINARY SUGGESTIONS

1. Return tests to the pupils to find out their own errors.
2. Put this list of errors on the blackboard to help them determine their errors.

ERRORS MADE IN SUBTRACTION

1. Lack of knowledge of subtraction facts.
2. Confused with addition facts.
3. Borrowing errors.
   a. Borrowed when no need.
   b. Forgot to borrow.
      Single, double or triple borrowing.
   c. Did not know how to borrow.
      Inverted numbers when smaller number was on top. Instead of saying 8 from 11 leaves 3, they said 1 from 8 leaves 7.

ILLUSTRATION

$$\begin{array}{r} 21 \\ -18 \\ \hline 17 \end{array}$$

4. Zero difficulties.
   a. Did not know how to borrow if zero was in the minuend.
   b. Forgot to borrow when there were two zeros in minuend.
   c. Ignored zero entirely. Jumped over it.

EXHIBIT 5 WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN

SUBTRACTION

PRELIMINARY SUGGESTIONS

1. Return tests to the pupils to find out their own errors.

2. Put this list of errors on the blackboard to help them determine their errors.

ERRORS MADE IN SUBTRACTION

1. Lack of knowledge of subtraction facts.

2. Confused with addition facts.

3. Borrowing errors.

a. Borrowed when no need.

b. Forgot to borrow.

Single, double or triple borrowing.

c. Did not know how to borrow.

Inverted numbers when smaller number was on top. Instead of saying 8 from 11 leaves 3, they said 1 from 8 leaves 7.

ILLUSTRATION

$$\begin{array}{r} 21 \\ -18 \\ \hline 17 \end{array}$$

4. Zero difficulties.

a. Did not know how to borrow if zero was in the minuend.

b. Forgot to borrow when there were two zeros in minuend.

c. Ignored zero entirely. Jumped over it.

d. Confused with multiplication facts.

Anumber from zero leaves zero.

5. Dangling ends - omitted entirely.

3. Collect these tests and return to me.

SUGGESTIONS.

1. Have pupils make a list of their own errors, using the list on the blackboard to help.
2. Have Pupils card the facts that they failed on.
3. Plan to spend 20 minutes a day for 3 days a week on corrective work in subtraction.
4. Plan to give 5 written examples a day in subtraction. Include zeros in the minuend and subtrahend, double and triple borrowing and examples in money.
5. Limit the drill load.

   Have the pupils realize that in subtraction there are:

   100 primary facts.

   175 related facts needed for subtracting in uneven short division through 89 9.

   275 total needed to be learned.
6. Organize material into small working units.

   Divide class into small groups, using the pupils who attained 100% as leaders.

   Group pupils according to failures made.

   Drill on facts.

   Drill on borrowing.

   Drill on zero difficulties.
7. Teach CHECKING.

d. Confused with multiplication facts.

Answer from zero leaves zero.

b. Dangling ends - omitted entirely.

3. Collect these tests and return to me.

SUGGESTIONS.

1. Have pupils make a list of their own errors, using the list on the blackboard to help.

2. Have Pupils card the facts that they failed on.

3. Plan to spend 20 minutes a day for 3 days a week on corrective work in subtraction.

4. Plan to give 5 written examples a day in subtraction. Include zeros in the minuend and subtrahend, double and triple borrowing and examples in money.

5. Limit the drill load.

Have the pupils realize that in subtraction there are:

100 primary facts.

175 related facts needed for subtracting in uneven short division through 89 9.

275 total needed to be learned.

6. Organize material into small working units.

Divide class into small groups, using the pupils who attained 100% as leaders.

Group pupils according to failures made.

Drill on facts.

Drill on borrowing.

Drill on zero difficulties.

7. Teach CHECKING.

Add remainder to subtrahend and get the minuend.

SUGGESTED FORM

39065 minuend.
-21983 subtrahend.

17082 remainder.

8. Keep accurate records of work done every day.

Graph for individual scores.

Chart on board for class record of perfect scores.

EXHIBIT 6 ANALYSIS OF M. P. TEST.

PROCESS STEP DIFFICULTIES	EXAMPLES
1. Multiplication facts	a e
2. Dollars and cents	b d f g h n t
3. 1 place multiplier	
No carrying	c d
With carrying	b f h
4. 2 place multiplier	
No carrying	g i
With carrying	j k l m n o
5. 3 place multiplier	
No carrying	p s
With carrying	q r t u v w x
6. Single zero in multiplier	g q r s t u w
7. Double zero in multiplicand or multiplier	h p y

(Continued on next page.)

EXHIBIT 6 ANALYSIS OF M. P. TEST.

PROCESS STEP DIFFICULTIES	EXAMPLES
1. Multiplication facts	a e
2. Dollars and cents	b d f g h n t
3. 1 place multiplier No carrying	c d
With carrying	b f h
4. 2 place multiplier No carrying	g i
With carrying	j k l m n o
5. 3 place multiplier No carrying	p s
With carrying	q r t u v w x
6. Single zero in multiplier	g q r s l u w
7. Double zero in multiplicand or multiplier	n p y

(Continued on next page.)

EXHIBIT 6 (CONT.) FREQUENCY OF ERRORS MADE IN M. P. TEST.

EXAMPLES	ERRORS
a	31
b	37
c	24
d	45
e	95
f	53
g	147
h	79
i	58
j	48
k	72
l	65
m	57
n	120
o	97
p	82
q	86
r	121
s	85
t	183
u	80
v	67
w	94
x	122
y	92

This analysis shows that in the M. P. Test no one example was done perfectly by any child. The smallest number of errors on one example was 24 and the largest was 183. This shows that multiplication facts as well as addition facts are not well learned.

The examples which caused most failures were:

g. 147 errors which involved money ($.), a two place multiplier and single zero in both multiplicand and multiplier.

n. 120 errors which involved money ($.), a 2 place multiplier with carrying.

r. 121 errors which involved a 3 place multiplier with carrying and a single zero in multiplier.

t. 183 errors which involved money ($.), a 3 place multiplier, with carrying, and a single zero in both multiplier and multiplicand.

x. 122 errors which involved a 3 place multiplier with carrying.

EXHIBIT 6 (CONT.) FREQUENCY OF ERRORS MADE IN M. P. TEST.

EXAMPLES	ERRORS
a	81
b	87
c	24
d	45
e	95
f	85
g	147
h	79
i	58
j	48
k	72
l	65
m	87
n	120
o	97
p	82
q	86
r	121
s	85
t	183
u	80
v	87
w	94
x	122
y	92

M. P. Test no one example was done perfectly by any child. The smallest number of errors on one example was 24 and the largest was 183. This shows that multiplication facts as well as addition facts are not well learned.

The examples which caused most failures were:

g. 147 ... errors which involved money ($.), a two place multiplier and single zero in both multiplicand and multiplier.

n. 120 errors which involved money ($.), a 2 place multiplier with carrying.

r. 121 errors which involved a 3 place multiplier with carrying and a single zero in multiplier.

t. 183 errors which involved money ($.), a 3 place multiplier, with carrying, and a single zero in both multiplier and multiplicand.

x. 122 errors which involved a 3 place multiplier with carrying.

CHART III CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL M. P. TEST IN OCTOBER.

SCORE	ROOMS					
In%	L	W	J	H	R	TOTAL
100	0	0	0	0	0	0
96	0	0	0	1	0	1
92	1	1	1	0	4	7
88	0	2	1	0	2	5
84	0	1	1	1	5	8
80	0	2	3	3	3	11
76	3	1	7	6	2	19
72	2	3	4	1	4	14
68	3	2	4	3	4	16
64	2	2	1	3	4	12
60	1	2	4	5	3	15
56	2	4	3	0	2	11
52	2	1	1	1	2	7
48	7	4	2	4	0	17
44	3	6	0	3	1	13
40	1	1	0	1	0	3
36	2	2	1	o	1	6
32	1	0	0	0	0	1
28	2	1	1	1	0	5
24	0	0	1	2	0	3
20	1	0	0	0	0	1
16	1	1	0	0	1	3
12	2	0	0	0	0	2
8	0	1	0	0	0	1
4	0	1	1	0	0	2
0	3	0	0	1	0	4
TOTALS	39	38	36	36	38	187

MEDIAN SCORE 60% TIME 13 Minutes.

MEAN SCORE 57.71% TIME 13.73 Minutes.

CHART III CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL M. P. TEST IN OCTOBER.

SCORE	ROOMS					
In%	L	W	J	H	R	TOTAL
100	0	0	0	0	0	0
96	0	0	0	1	0	1
92	1	1	1	0	4	7
88	0	2	1	0	2	5
84	0	1	1	1	5	8
80	0	2	3	3	3	11
76	3	1	7	6	2	19
72	2	3	4	1	4	14
68	3	2	4	3	4	16
64	2	2	1	3	4	12
60	1	2	4	5	3	15
56	2	4	3	0	2	11
52	2	1	1	1	2	7
48	7	4	2	4	0	17
44	3	6	0	3	1	13
40	1	1	0	1	0	3
36	2	2	1	0	1	6
32	1	0	0	0	0	1
28	2	1	1	1	0	5
24	1	0	1	2	0	3
20	1	0	0	0	0	1
16	1	1	0	0	1	3
12	2	0	0	0	0	2
8	0	1	0	0	0	1
4	0	1	1	0	0	2
0	3	0	0	1	0	4
TOTALS	39	38	36	36	38	187

MEDIAN SCORE 60% TIME 13 Minutes.

MEAN SCORE 57.7% TIME 13.75 Minutes.

EXHIBIT 7 WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN MULTIPLICATION.

These errors were very noticeable during the correction of this set of tests.

1. Lack of knowledge of multiplication facts. (Response is not automatic.)
2. Zero facts were very bothersome.

   Zero difficulties noted.

   a. When at the end of a number, the pupil dropped them.

   b. If in the multiplier, they were ignored.

   c. If in the multiplicand, they were ignored by jumping over.
3. Method of placing the decimal point correctly was not known. Pupils counted from the left instead of the right.
4. Dollar signs and decimal points were omitted.
5. Partial products were incorrectly placed, especially with a 3 - figure multiplier.
6. Confusions existed between processes.

   a. Confused with addition.

   b. Confused with subtraction.
7. Confusions were caused by poorly made figures.
8. Carrying difficulties in addition were many.
9. Some pupils forgot to carry.

10. Lack of knowledge of correct procedure in multiplication was noted. Omitted the second or third figure of the multiplier and forgot to multiply by them entirely.
11. Many pupils took too long to work in this process due largely to the habit of saying tables to themselves to get the desired product they needed.

SUGGESTIONS.

1. Give tests to pupils to find out their own errors.
2. Have rapid daily drill working for automatic response with flash cards or orally or written.
3. Teach the 100 multiplication facts INDIVIDUALLY, and not as tables.
4. Use a definite teaching plan for teaching the process steps. Suggested plan based on Wilson's 100% Accuracy Drill Books.(1)

   Steps.

   a. PRIMARY FACTS.

0	5	7	7	6
x5	x9	x9	x1	x2

   b. Their reverses.

5	9	9	1	2
x0	x5	x7	x7	x6

   c. One place multiplier-no carrying.

   d. One place multiplier carrying requiring addition in the same decade.

(1) WILSON Guy M., MY MULTIPLICATION AND SHORT DIVISION DRILL BOOK Macmillan Co., New York, 1932.

10. Lack of knowledge of correct procedure in multiplication was noted. Omitted the second or third figure of the multiplier and forgot to multiply by them entirely.

11. Many pupils took too long to work in this process due largely to the habit of saying tables to themselves to get the desired product they needed.

SUGGESTIONS.

1. Give tests to pupils to find out their own errors.

2. Have rapid daily drill working for automatic response with flash cards or orally or written.

3. Teach the 100 multiplication facts INDIVIDUALLY, and not as tables.

4. Use a definite teaching plan for teaching the process steps. Suggested plan based on Wilson's 100% Accuracy Drill Books.(1)

Steps.

a. PRIMARY FACTS.

$$\begin{array}{cccccc} & 0 & 8 & 7 & 7 & 8 \\ & x5 & x9 & x9 & x1 & x2 \end{array}$$

b. Their reverses.

$$\begin{array}{cccccc} & 5 & 9 & 9 & 1 & 2 \\ & x0 & x5 & x7 & x7 & x6 \end{array}$$

c. One place multiplier-no carrying.

d. One place multiplier carrying requiring addition in the same decade.

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e. One place multiplier, carrying requiring addition into a higher decade.

f. One place multiplier, zero in the multiplicand, with and without carrying to the zero.

g. Two and three place multiplier, no carrying.

h. Two and three place multiplier, with carrying.

i. Single zero in the multiplier.

j. Double zeros in the multiplicand or multiplier.

5. Keep work simple and within the ability of the pupils.

a. One place multiplier, carrying requiring addition
into a higher decade.

f. One place multiplier, zero in the multiplicand,
with and without carrying to the zero.

g. Two and three place multiplier, no carrying.

h. Two and three place multiplier, with carrying.

i. Single zero in the multiplier.

j. Double zeros in the multiplicand or multiplier.

5. Keep work simple and within the ability of the pupils.

CHART IV CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM IN THE INITIAL L. D. P. TEST IN OCTOBER

SCORE	ROOMS					
In%	L	W	J	H	R	TOTAL
100	0	0	3	1	2	6
96	1	0	3	2	1	7
92	0	5	3	0	3	11
88	4	6	6	6	3	25
84	0	0	8	2	8	18
80	0	4	3	4	6	17
76	2	1	0	5	3	11
72	2	1	3	2	2	10
68	4	6	2	3	2	17
64	4	0	1	3	1	9
60	1	3	1	1	1	7
56	2	1	0	1	2	6
54	0	0	1	0	2	3
48	2	2	1	2	1	8
44	2	0	0	0	0	2
40	1	2	1	1	0	5
36	1	1	0	0	0	2
32	1	1	0	0	0	2
28	1	0	0	0	1	2
24	0	0	0	0	0	0
20	1	0	0	0	0	1
16	0	1	0	2	0	3
12	2	1	0	1	1	5
8	0	2	0	0	0	2
4	1	0	0	0	0	1
0	4	2	0	1	0	7
TOTALS	36	39	36	37	39	187

MEDIAN SCORE 76% TIME 24 Minutes.

MEAN SCORE 66.46% TIME 26.36 Minutes.

CHART IV CHART SHOWING SPREAD OF SCORES OBTAINED IN EACH ROOM

IN THE INITIAL I. D. P. TEST IN OCTOBER

SCORE	ROOMS				
In%	L	N	J	K	H	TOTAL
100	0	0	3	1	2	6
96	1	0	3	2	1	7
92	0	0	3	0	3	11
88	0	0	6	6	8	25
84	0	0	3	2	8	18
80	0	0	3	4	3	17
76	2	0	2	5	3	11
72	2	1	2	2	2	10
68	4	0	1	3	2	12
64	4	0	1	1	1	9
60	1	0	1	0	2	7
56	2	0	1	0	1	5
52	0	0	2	0	1	5
48	2	0	2	0	0	5
44	2	0	1	0	0	3
40	1	1	0	0	0	2
36	1	1	0	0	0	2
32	1	0	0	0	1	2
28	1	0	0	0	0	1
24	0	0	0	0	0	0
20	1	0	0	0	0	1
16	2	1	0	1	0	4
12	1	0	0	0	1	2
8	0	0	0	0	0	0
4	1	0	0	0	0	1
0	4	2	0	1	0	7
TOTALS	36	39	36	37	39	187

MEDIAN SCORE 76% TIME 24 Minutes.

MEAN SCORE 86.48% TIME 26.36 Minutes.

EXHIBIT 8 WRITTEN SUGGESTIONS FOR CORRECTIVE WORK IN LONG DIVISION.

In order to determine the lacks in division, one set of tests was very closely diagnosed for errors. The following items were noted:

1. Many errors were due to lack of knowledge of the other fundamental processes addition, subtraction, and multiplication.
2. Carrying in addition, borrowing in subtraction and lack of knowledge of multiplication facts were still stumbling blocks.
3. Failure to compare at every step was very noticeable.
4. Many confusions between processes and in process steps still exist in the minds of many pupils.
5. Pupils did not know how to work an example when there was either a 3 or 4 figure divisor.
6. The wrong figure was often brought down.
7. The wrong figure was put in the quotient but the correct figure was used in multiplying.
8. The quotient figure was not put down although they used it to multiply.
9. The quotient figure was often placed incorrectly.
10. All the figures in the dividend were not used. The example was left as finished when only half done.
11. Some pupils did not know what to do when the remainder was larger than the divisor.

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8. The quotient figure was not put down although they used it to multiply.
9. The quotient figure was often placed incorrectly.
10. All the figures in the dividend were not used. The example was left as finished when only half done.
11. Some pupils did not know what to do when the remainder was larger than the divisor.

12. Some pupils did not know what to do when the quotient figure was too large.

13. Some pupils did not know how to use a trial divisor.

14. A zero at the end of the quotient was omitted.

SUGGESTIONS.

1. Give tests to pupils to find out their own errors.

2. Help them to locate errors by giving them this table:

ERRORS. Check each of these in turn to find your weak point.

Bringing down

Placing quotient figures.

Multiplication facts. Note each fact missed. Drill.

Addition errors. Note each fact missed. Drill.

Subtraction errors, especially borrowing.

Remainders.

3. Put on the blackboard the process steps for long division.

I. DIVIDE. Place the trial quotient properly.

II. MULTIPLY. COMPARE.

III. SUBTRACT. COMPARE.

IV. BRING DOWN. COMPARE.

V. WRITE R after remainder if there is a remainder. (1)

VI. CHECK the answer.

(1) WILSON Guy M., MY LONG DIVIDION DRILL BOOK Macmillan Co,, New York, 1934.

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13. Some pupils did not know how to use a trial divisor.

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Addition errors. Note each fact missed. Drill.

Subtraction errors, especially borrowing.

Remainders.

3. Put on the blackboard the process steps for long division.

I. DIVIDE. Place the trial quotient properly.

II. MULTIPLY. COMPARE.

III. SUBTRACT. COMPARE.

IV. BRING DOWN. COMPARE.

V. WRITE A after remainder if there is a remainder.

VI. CHECK the answer.

(1) WILSON Guy M., MY LONG DIVISION DRILL BOOK Macmillan Co., New York, 1934.

Multiply the quotient by the divisor, add in any remainder and the product should be the dividend if the work is correct.

4. Review the short division facts, both the even and the uneven facts.
5. Use a definite teaching plan for teaching the process steps. The following plan is suggested in Dr. Wilson's Drill Book:

I. Two-place divisor, right-hand figure very small, no carrying in the multiplication, no borrowing in the subtraction, no remainders. (Divide by numbers ending in 0, 1, 2 and 3.)

II. Two-place divisor three or four-place dividend, no carrying or borrowing, some remainders.

III. First partial dividend requiring one more digit than the divisor contains, no carrying or borrowing, some remainders.

IV. Larger right-hand figure in the divisor, carrying in the multiplication, some remainders.

V. Borrowing in the subtraction, no carrying in the multiplication.

VI. Carrying in the multiplication, and borrowing in the subtraction.

VII. Easy examples with more than three figures in the divisor.

VIII. Zero in the dividend.

IX. Zero in the quotient.

Multiply the quotient by the divisor, and in any remainder and the product should be the dividend if the work is correct.

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IV. Larger right-hand figure in the divisor, carrying in the multiplication, some remainders.

V. Borrowing in the subtraction, no carrying in the multiplication.

VI. Carrying in the multiplication, and borrowing in the subtraction.

VII. Easy examples with more than three figures in the divisor.

VIII. Zero in the dividend.

IX. Zero in the quotient.

X. When the trial quotient is not the true quotient.

6. Keep the work simple and within the ability of the pupil.

7. Keep daily records of each pupil's work.

2. AN ENLARGED OPPORTUNITY.

Very unexpectedly the writer was given an opportunity by the master to present the results of the Initial Tests to the teachers who taught arithmetic in the district. This was done at the close of one of the regular monthly teachers' meetings. The method of procedure used in the corrective work was briefly described. The results were given of each test for each process. Since such poor results were obtained in multiplication, it was decided to have a short period of concentration on that process in every grade above the third. A few suggestions were made. The teaching of the 100 multiplication facts as isolated facts and not as tables was strongly urged as the practice to be followed by every teacher in every grade. Flash card drills given daily for a short period was also advocated. The adoption of a definite plan for teaching the process steps was urged upon all. The teachers showed a great deal of interest and a fine spirit of cooperation. A few had already been using the same plan of teaching as the writer and had found it very successful. They gladly added words of recommendation.

This plan included, giving the tests, carefully diagnosing them for specific errors, limiting the drill load, planning small units of work, using pupils who had a perfect score as leaders of small groups, and Re-testing to show progress. The idea of keeping all work done within the ability of the child is a definite part of this teaching plan. Success

must be an accompaniment of learning. It is sometimes necessary to restore confidence in the child who has been so used to failure that he has given up all hope of ever succeeding in any arithmetical work. Small units of work, 5 examples a day worked and proved will often secure this result. Short, well planned, daily drill periods are most effective. Inspiration and a determination to try for 100% results in arithmetical drill work were the outcomes of this period of discussion.

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CHAPTER IV. WORK DONE IN EXPERIMENTAL GROUP.

1. COMPOSITION OF GROUP.

2. TIME GIVEN TO CORRECTIVE PROGRAM, AND GROUND COVERED.

3. PROCEDURE IN ADDITION.

    (a) NOTE BOOK.

    (b) INDIVIDUAL FLASH CARDS.

    (c) WALL CHARTS.

    (d) INDIVIDUAL GRAPHS.

4. PROCEDURE IN MULTIPLICATION.

    (a) INDIVIDUAL DIAGNOSIS OF ERRORS.

    (b) SAMPLES OF DAILY DRILLS.

    (c) CHECK BY DIVISION TAUGHT.

5. PROCEDURE IN LONG DIVISION.

    (a) DIAGNOSIS OF ERRORS COMMON TO GROUP.

    (b) PROCESS STEPS IN LONG DIVISION.

    (c) CHECK BY MULTIPLICATION.

CHAPTER IV WORK DONE IN EXPERIMENTAL GROUP.

1. COMPOSITION OF GROUP.

The experimental group in this study is one of the participating sixth grades. It is an ordinary class, made up of 38 pupils, 18 boys and 20 girls. Their ages vary from 9 yrs. 9 mos. to 13 yrs. 6 mos. The intelligence ratios vary from 68 to 139. The chronological ages are as of Sept. 1, 1938. The intelligence ratios are the result of the National Intelligence Test Scale A Form 1 given in October by the city. The variation in the intelligence ratios for the class is as follows:

Inferior	Below 75	1 pupil	2.63 %
Below Average	75-90	8 pupils	21.04
Average	90-110	16 pupils	42.08
Above Average	110-125	11 pupils	28.93
Superior	Above 125	2 pupils	5.26
		38	99.94

This shows that the class is average in ability.

The variation in Chronological ages is as follows:

Years	Pupils		%
9	2	or	5.26
10	18		47.34
11	9		23.67
12	5		13.15
13	4		10.52
	38		99.94

This shows that the class is of average age.

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Inferior	Below 75	1 pupil	2.63
Below Average	75-90	8 pupils	21.04
Average	90-110	16 pupils	42.08
Above Average	110-125	11 pupils	28.93
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10	18		47.34
11	9		23.67
12	5		13.15
13	4		10.52
	38		99.94

This shows that the class is of average age.

2. TIME SPENT BY THIS GROUP ON CORRECTIVE WORK AND GROUND COVERED.

Since this is the first year that the writer has tried to work the corrective program with a class and carry along the regular work in arithmetic for the grade at the same time, it took a good deal of planning to keep both going well. Twenty-five minutes three mornings a week was spent on corrective work. For the regular grade work they had a 20 minute period on fractions after a 10 minute rest period of physical exercises. One day a week the entire time was spent on a written test, including work covered in both periods. The fifth day's time was spent on problem work. So 75 minutes a week for five months means that approximately 25 hours was spent by this group on corrective arithmetic.

More time was spent on the addition process. This was about three months. One month was spent on multiplication, while about two weeks were spent on long division. Subtraction was not definitely reviewed because it seemed advisable to spend more time on multiplication. It took a week at either end to give the tests so that the five month's work included in this study in this experimental group covered the above mentioned ground.

Since this is only the work of half a school year, as much progress will not be shown as would be possible if it covered an entire year. Neither was it possible to hold back

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Since this is only the work of half a school year, as much progress will not be shown as would be possible if it covered an entire year. Neither was it possible to hold back

until all errors had been eliminated in one process before going on to another as should have been done. Since we learn by doing, another year will profit by the errors made or difficulties met and overcome, and better results should follow.

3. PROCEDURE IN TEACHING THE ADDITION PROCESS.

(a) USE OF NOTE BOOK.

Each pupil made a loose leaf arithmetic note book. The first thing put into it were the addition facts. An effort was made to show the class that there was a definite number of facts for them to know, and to impress upon them the fact that if they learned them once, they never needed to learn them again. The facts were arranged in ten groups, based on the plan of Dr. Wilson in his drill books. Each page had three sections labeled primary facts, upper decade facts and related facts needed for carrying in multiplication. (See next page for sample page showing grouping.)

(b) USE OF INDIVIDUAL FLASH CARDS.

Each pupil next made a pack of cards which contained the addition facts on which he failed in doing his work. This pack grew as his errors grew, and diminished as his errors grew less after drill. In this way each child drilled on just the facts on which he needed to drill, and as soon as they were learned so that he could give the answer automatically, he put them in his pile of known facts. These two packs were kept in his desk where he could use them at odd moments and in the regular drill period. They worked in pairs usually, each one hearing the other say his pile of unknown facts each day. It was surprising to see how the regular daily practice helped some. Some of the children took their packs home to play with and to study at home. This learning was intended to overcome counting.

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Each pupil next made a pack of cards which contained the addition facts on which he failed in doing his work. This pack grew as his errors grew, and diminished as his errors grew less after drill. In this way each child drilled on just the facts on which he needed to drill, and as soon as they were learned so that he could give the answer automatically, he put them in his pile of known facts. These two packs were kept in his desk where he could use them at odd moments and in the regular drill period. They worked in pairs usually, each one hearing the other say his pile of unknown facts each day. It was surprising to see how the regular daily practice helped some. Some of the children took their packs home to play with and to study at home. This learning was intended to overcome counting.

EXHIBIT 9 SAMPLE PAGE FROM NOTE BOOK.

GROUP I

Primary Facts.

3	4	3	2	6	4	9	5	2	1
2	5	9	2	4	6	3	4	3	1
5	9	12	4	10	10	12	9	5	2

Related Facts.

12+3= 15	15+4= 19	19+3= 22	12+2= 14
22+3= 25	25+4= 29	29+3= 32	22+2= 24
32+3= 35	35+4= 39	39+3= 42	32+2= 34
14+6= 20	16+4= 20	13+9= 22	14+5= 19
24+6= 30	26+4= 30	23+9= 32	24+5= 29
34+6= 40	36+4= 40	33+9= 42	34+5= 39
13+2= 15	11+1= 12		
23+2= 25	21+1= 22		
33+2= 35	31+1= 32		

Related Facts For Carrying In Multiplication.

42+3= 45	42+2= 44	54+6= 60
72+3= 75	72+2= 74	64+6= 70
		54+5= 59
45+4= 49	56+4= 60	64+5= 69
49+3= 52	63+2= 65	81+1= 82

53 Facts.

NOTE: Ten pages included all the 480 Addition Facts.

EXHIBIT 9 SAMPLE PAGE FROM NOTE BOOK.

GROUP I

Primary Facts.

3	4	3	2	6	4	9	5	8	1
2	5	9	2	4	6	3	4	3	1
5	9	12	4	10	10	12	9	5	2

Related Facts.

12+3= 15	15+4= 19	19+3= 22	12+2= 14
22+3= 25	25+4= 29	29+3= 32	22+2= 24
32+3= 35	35+4= 39	39+3= 42	32+2= 34
14+6= 20	16+4= 20	16+6= 22	14+5= 19
24+6= 30	26+4= 30	23+6= 32	24+5= 29
34+6= 40	36+4= 40	33+6= 42	34+5= 39
13+2= 15	11+1= 12		
23+2= 25	21+1= 22		
33+2= 35	31+1= 32		

Related Facts For Carrying In Multiplication.

42+3= 45	42+2= 44	34+6= 80
72+3= 75	72+8= 74	64+6= 70
		54+5= 59
45+4= 49	36+4= 60	84+5= 89
49+3= 52	83+2= 85	81+1= 82

53 Facts.

NOTE: Ten pages included all the 480 Addition Facts.

It was a great help in establishing confidence and showed what could be accomplished with a little work and concentration.

As soon as the class realized that the 480 facts could be learned automatically, they spent some time trying to master them. It was not possible to give all the time necessary for each one to attain 100% accuracy in the number facts before going on to the process steps involved in addition as should have been done, so this fact doubtless made for greater errors than would have been the case if some pupils had not been hurried.

(c) USE OF WALL CHARTS

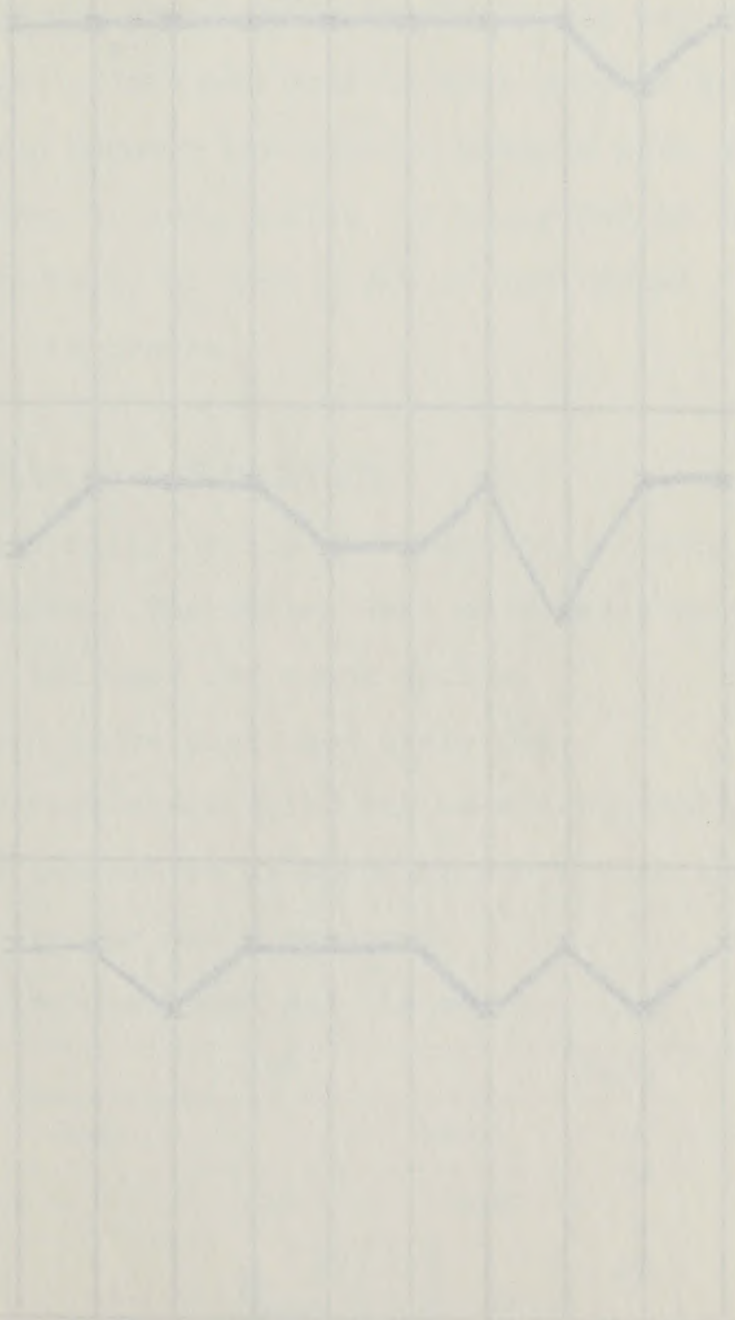
Large wall charts were made of the five charts given in the back of "My Addition Drill Book"(1). These were used first for the primary fact drill. Each number in the column was added to the number in heavy type at the top. Later they were used for column addition. Variety was introduced by adding up, down and across. This helped in carrying and in overcoming counting.

(d) USE OF GRAPHS FOR KEEPING INDIVIDUAL RECORDS BY THE PUPILS.

Five examples a day were given. Each example had to be worked out and then proved. They were marked. Each child kept his own record of results on a graph. The line graph was

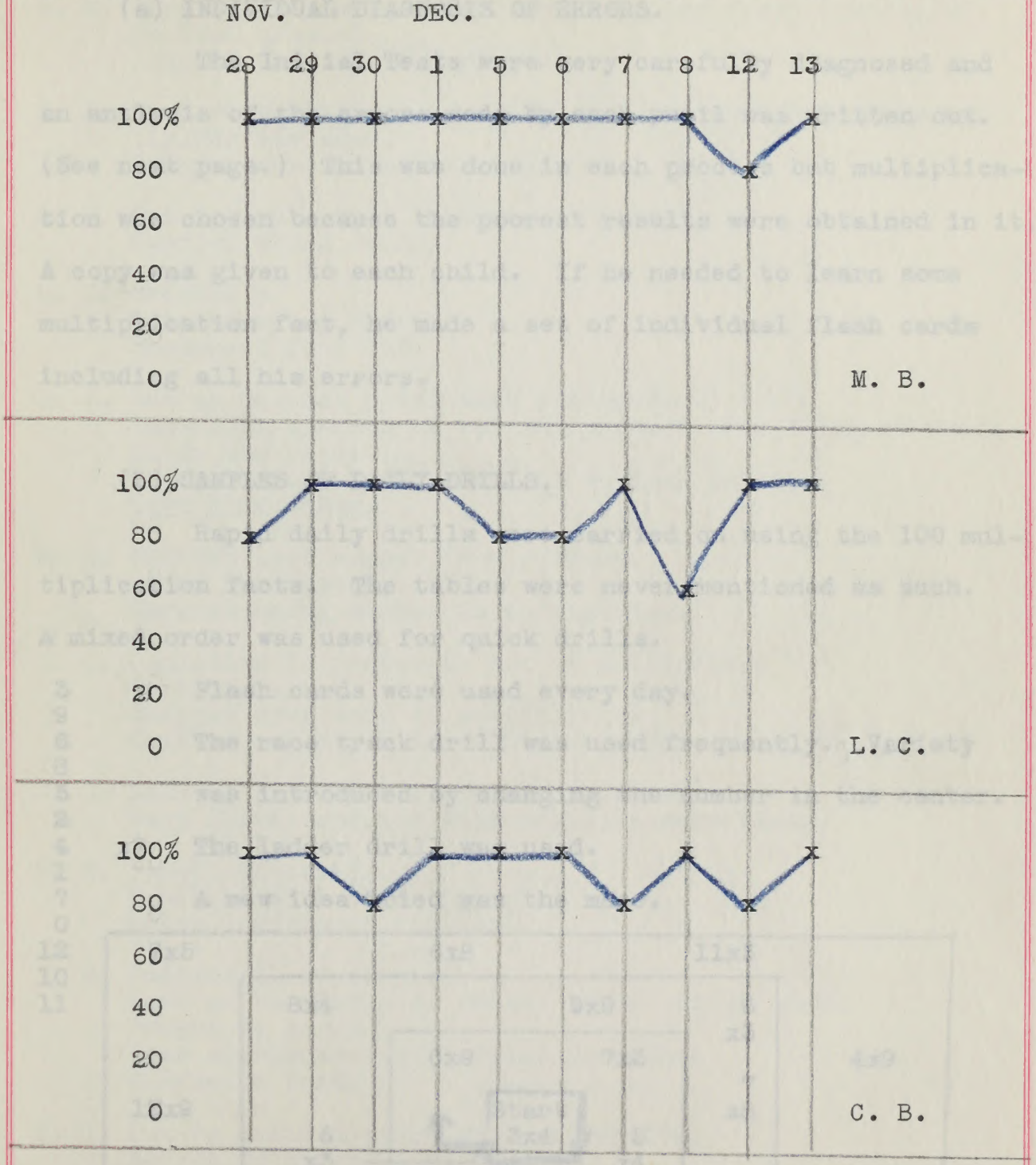
(1) Op. Cit.

used, and they soon saw how quickly they could tell if they were improving or not, Progress was not always steady, as the line often showed. (See samples in EX. 10.)



used, and they soon saw how quickly they could tell if they were improving or not. Progress was not always steady, as the line often showed. (See samples in EX. 10.)

EXHIBIT 10 MY ADDITION GRAPH.



Sample to show how pupils kept their own daily records.

EXHIBIT 10 MY ADDITION CHART.

Sample to show how pupils kept their own daily records.

4. PROCEDURE IN MULTIPLICATION.

(a) INDIVIDUAL DIAGNOSIS OF ERRORS.

The Initial Tests were very carefully diagnosed and an analysis of the errors made by each pupil was written out. (See next page.) This was done in each process but multiplication was chosen because the poorest results were obtained in it. A copy was given to each child. If he needed to learn some multiplication fact, he made a set of individual flash cards including all his errors.

(b) SAMPLES OF DAILY DRILLS.

Rapid daily drills were carried on using the 100 multiplication facts. The tables were never mentioned as such. A mixed order was used for quick drills.

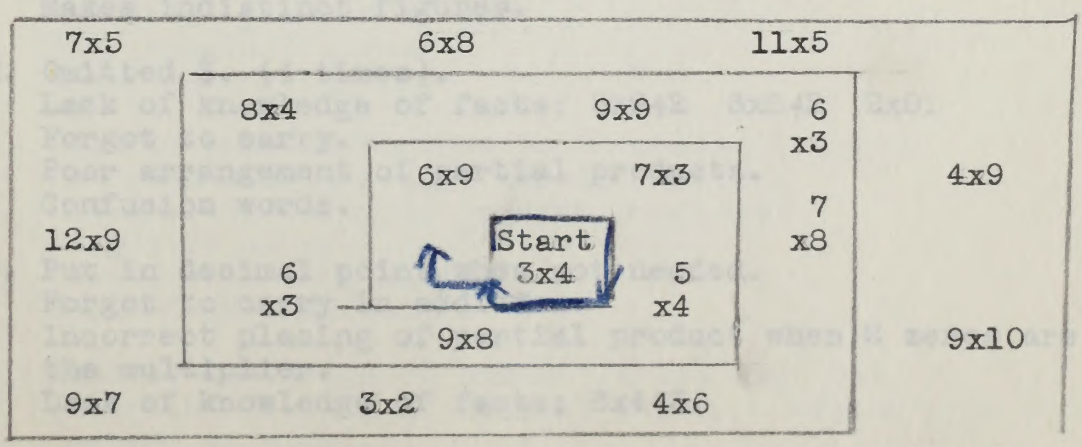
3
9
6
8
5
2
4 x7
1
7
0
12
10
11

Flash cards were used every day.

The race track drill was used frequently. Variety was introduced by changing the number in the center.

The ladder drill was used.

A new idea tried was the maze.



SUCCESS!!

4. PROCEDURE IN MULTIPLICATION.

(a) INDIVIDUAL DIAGNOSIS OF ERRORS.

The Initial Tests were very carefully diagnosed and an analysis of the errors made by each pupil was written out. (See next page.) This was done in each process but multiplication was chosen because the poorest results were obtained in it. A copy was given to each child. If he needed to learn some multiplication fact, he made a set of individual flash cards including all his errors.

(b) SAMPLES OF DAILY DRILLS.

Rapid daily drills were carried on using the 100 multiplication facts. The tables were never mentioned as such.

A mixed order was used for quick drills.

Flash cards were used every day.

The race track drill was used frequently. Variety was introduced by changing the number in the center.

xy The ladder drill was used.

A new idea tried was the maze.

EXHIBIT 11 DIAGNOSIS OF MULTIPLICATION ERRORS FOR ROOM R.

E. B. When 3 place multiplier was used, incorrect placing of partial product.
Ignored zero in tens place.

C. P. Incorrect placing of partial product when a 3 place multiplier was used.
Ignored zero in units place.

L. H. Put decimal point in when not needed.
Carried wrong number.

R. T. Omitted $.
Carried wrong number.
Incorrect fact 8x8.

S. S. Put in decimal point when not needed.
Incorrect placing of partial product when 3 figure multiplier was used.
Counted wrong for placing of decimal point.
Zero difficulty.

E. D. Omitted last number from product.
Added incorrectly.
Carried wrong number in multiplying.

H. L. Confusion in number to use as multiplier.
Omitted $.
Skipped over zero in multiplying.
Omitted one digit in multiplier when it had 3 figures.

J. C. Lack of knowledge of facts; 7x9 9x4.
Zero facts confused with addition zero facts.

P. N. Forgot to carry.
Confused with subtraction.
Makes indistinct figures.

F. M. Omitted $. (4 times).
Lack of knowledge of facts; 5x9+2 3x8+2 2x0.
Forgot to carry.
Poor arrangement of partial products.
Confusion words.

M. C. Put in decimal point when not needed.
Forgot to carry in addition.
Incorrect placing of partial product when 2 zeros are in the multiplier.
Lack of knowledge of facts; 8x4+3.

A. C. Carried wrong number in addition.
Omitted decimal point and $.
Omitted zero in multiplying by jumping over it.
Incorrect placing of partial products.

R. H. Confusion of two methods. (Came from another school where they multiplied by the left hand figure first.)
Omitted zero at end.
Incorrect placing of partial products.
Confusion with addition.

D. Q. Omitted $.
Wrong number carried in addition.

L. F. Omitted decimal point.
Omitted zero.
Lack of knowledge of number facts; 7x9 7x7.

T. E. Decimal point omitted.
Omitted part of number (put 4 instead of 14).
Incorrect placing of partial products.
Lack of knowledge of number facts; 9x7.

F. C. Lack of knowledge of number facts; 8x7 6x0 7x4+1.
Carried wrong number.
Multiplied instead of adding partial products.
Poorly made figures caused confusion.

S. F. Confused addition with multiplication.
Lack of knowledge of number facts; 9x4+2 8x8+7 7x6+5.
Incorrect placing of partial products.
Poor placing of partial products caused confusion in adding.
Omitted zeros at end.

W. B. Confused with addition(1x1+2).
Omitted $. and placed it incorrectly.
Incorrect placing of partial products.
Poorly made figures.
Wrong number carried.

T. K. Omitted part of figures to be multiplied.
Confused addition with multiplication.
Incorrect placing of partial products.
Forgot to carry.
Hopped over zero entirely.
Omitted decimal point.

M. B. Lack of knowledge of number facts; 3x0 4x9.
Incorrect placing of decimal point. Counted from left, instead of right.
Omitted zeros at end (4 times).
Carried wrong number.

A. C. Carried wrong number in addition.
Omitted decimal point and $.
Omitted zero in multiplying by jumping over it.
Incorrect placing of partial products.

R. H. Confusion of two methods. (Came from another school where they multiplied by the left hand figure first.)
Omitted zero at end.
Incorrect placing of partial products.
Confusion with addition.

D. G. Omitted $.
Wrong number carried in addition.

L. F. Omitted decimal point.
Omitted zero.
Lack of knowledge of number facts; 7x9 7x7.

T. E. Decimal point omitted.
Omitted part of number (put 4 instead of 14).
Incorrect placing of partial products.
Lack of knowledge of number facts; 8x7.

F. C. Lack of knowledge of number facts; 8x7 6x0 7x4+1.
Carried wrong number.
Multiplied instead of adding partial products.
Poorly made figures caused confusion.

S. F. Confused addition with multiplication.
Lack of knowledge of number facts; 8x4+2 8x8+7 7x6+5.
Incorrect placing of partial products.
Poor placing of partial products caused confusion in adding.
Omitted zeros at end.

W. B. Confused with addition(3+2).
Omitted $, and placed it incorrectly.
Incorrect placing of partial products.
Poorly made figures.
Wrong number carried.

I. K. Omitted part of figures to be multiplied.
Confused addition with multiplication.
Incorrect placing of partial products.
Forgot to carry.
Jumped over zero entirely.
Omitted decimal point.

M. B. Lack of knowledge of number facts; 3x0 4x3.
Incorrect placing of decimal point. Counted from left, instead of right.
Omitted zeros at end (4 times).
Carried wrong number.

R. R. Incorrect placing of decimal point, counted from left.
Incorrect placing of partial products.
Added instead of multiplying.
Omitted some figure in multiplicand.
Lack of knowledge of number facts; 8x8+7 6x4.

G. C. Incorrect placing of decimal point, counted from left.
Omitted $.
Confused about placing comma.
Confused with addition.

L. C. Lack of knowledge of number facts; 4x9 6x7+5 6x3 8x9+4 8x3 7x8+2.
Multiplied by another number than one given.
Incorrect placing of partial products.
Omitted $.

M. U. Lack of knowledge of number facts; 3x0 2x0 3x9+1.
Multiplied by same number twice.
Forgot to carry in addition.
Omitted $.
Confusion of addition with multiplication.

W. M. Forgot he carried and put down zeros.
Incorrect placing of partial products.
Ignored zero at end.
Omitted $.
Lack of knowledge of number facts; 8x8+7.

J. P. Lack of knowledge of number facts; 6x4 7x5 6x0 7x4 4x7.
Confusion with addition.
Omitted decimal point.

R. E. Lack of knowledge of number fact; 1x1.
Added decimal point when not necessary.
Omitted zeros at end (8 times).

D. L. Lack of knowledge of number facts; 6x3+3 8x9 6x3.
Forgot to carry in addition.
Confusion caused by poorly made figures.
Forgot to multiply by one digit of multiplier.

R. C. Lack of knowledge of number fact; 5x6.
Incorrect placing of decimal point.
Forgot to carry.
Confusion with addition.
Omitted figure in multiplicand.
Incorrect placing of partial products.

R. R. Incorrect placing of decimal point, counted from left.
Incorrect placing of partial products.
Added instead of multiplying.
Omitted some figure in multiplicand.
Lack of knowledge of number facts; 8x8+7 8x4.

S. C. Incorrect placing of decimal point, counted from left.
Omitted $.
Confused about placing commas.
Confused with addition.

T. C. Lack of knowledge of number facts; 4x9 8x7+5 8x8
8x9+4 8x5 7x6+2.
Multiplied by another number than one given.
Incorrect placing of partial products.
Omitted $.

M. U. Lack of knowledge of number facts; 5x0 8x0 3x9+1.
Multiplied by same number twice.
Forgot to carry in addition.
Omitted $.
Confusion of addition with multiplication.

W. M. Forgot be carried and put down zeros.
Incorrect placing of partial products.
Ignored zero at end.
Omitted $.
Lack of knowledge of number facts; 8x8+7.

I. P. Lack of knowledge of number facts; 8x4 7x8 6x0 7x4
+2?.
Confusion with addition.
Omitted decimal point.

R. R. Lack of knowledge of number fact; 1x1.
Added decimal point when not necessary.
Omitted zeros at end (8 times).

D. L. Lack of knowledge of number facts; 8x3+3 8x9 8x3.
Forgot to carry in addition.
Confusion caused by poorly made figures.
Forgot to multiply by one digit of multiplier.

R. C. Lack of knowledge of number fact; 8x8.
Incorrect placing of decimal point.
Forgot to carry.
Confusion with addition.
Omitted figure in multiplicand.
Incorrect placing of partial products.

D. C. Lack of knowledge of number facts; 7x7+5 8x8+2 8x8+7 7x6+2 4x7+1 9x0 3x8+1.
Omitted $.
Put figure to be carried in partial product.
Divided instead of multiplying.

M. H. Lack of knowledge of number facts; 6x0 0x3 6x7 9x8 7x9.
Lack of knowledge of table facts (9 table facts).
Zero facts not known.
Forgot to carry.
Confusion with subtraction and addition.
Incorrect placing of partial products.

H. B. Confused with addition facts.
Zero facts not known.
Forgot to carry.
Only used 1 figure of a 2 or 3 place multiplier.
Incorrect placing of partial products.

M. H. Lack of knowledge of number facts; 1x1 8x9+2 9x5.
Lack of knowledge of table facts (8 table facts).
Omitted $.
Omitted zero at end.
Forgot to carry.

J. G. Zero difficulty. Facts not known.
Multiplied by another number than one given.
Incorrect placing of decimal point, counts from left.
Omitted 5 examples.

A. J. Zero facts not known.
Lack of knowledge of number fact; 4x7.
Omitted decimal point or put in wrong place, counts from left.
Forgot to carry in addition.
Forgot zeros at end.
Jumped over zeros when multiplying.

H. M. Lack of knowledge of number facts; 6x5 7x8 6x7 9x7.
Incorrect placing of decimal point, counts from left.
Multiplied by same number twice.
Forgot to carry in addition.
Did not complete example.

J. B. Lack of knowledge of facts.
Carried wrong number.
Incorrect placing of decimal point, counts from left.
Forgot to carry in addition.
Multiplied by just one number instead of 2 or 3.

D. C. Lack of knowledge of number facts; 7x7+5 8x8+2 8x8+7
7x8+2 4x7+1 9x0 3x8+1.
Omitted $.
Put figure to be carried in partial product.
Divided instead of multiplying.

M. H. Lack of knowledge of number facts; 6x0 0x3 6x7 9x8
7x9.
Lack of knowledge of table facts (9 table facts).
Zero facts not known.
Forgot to carry.
Confusion with subtraction and addition.
Incorrect placing of partial products.

H. B. Confused with addition facts.
Zero facts not known.
Forgot to carry.
Only used 1 figure of a 2 or 3 place multiplier.
Incorrect placing of partial products.

M. H. Lack of knowledge of number facts; 1x1 8x9+2 9x5.
Lack of knowledge of table facts (8 table facts).
Omitted $.
Omitted zero at end.
Forgot to carry.

J. G. Zero difficulty. Facts not known.
Multiplied by another number than one given.
Incorrect placing of decimal point, counts from left.
Omitted 5 examples.

A. J. Zero facts not known.
Lack of knowledge of number fact; 4x7.
Omitted decimal point or put in wrong place, counts from
left.
Forgot to carry in addition.
Forgot zeros at end.
Jumped over zeros when multiplying.

H. M. Lack of knowledge of number facts; 6x5 7x8 6x7 9x7.
Incorrect placing of decimal point, counts from left.
Multiplied by same number twice.
Forgot to carry in addition.
Did not complete example.

J. B. Lack of knowledge of facts.
Carried wrong number.
Incorrect placing of decimal point, counts from left.
Forgot to carry in addition.
Multiplied by just one number instead of 2 or 3.

From the individual diagnosis of errors it was seen that lack of knowledge of facts was one of the chief difficulties. Zeros were also a cause of great difficulty, as was the placing of the decimal point and the correct placing of partial products especially when a 2 or 3 place multiplier was involved. Therefore in the daily drill period the work was arranged to cover each of these difficulties in turn. One was taught at a time. In the weekly test examples including these difficulties in each process were included.

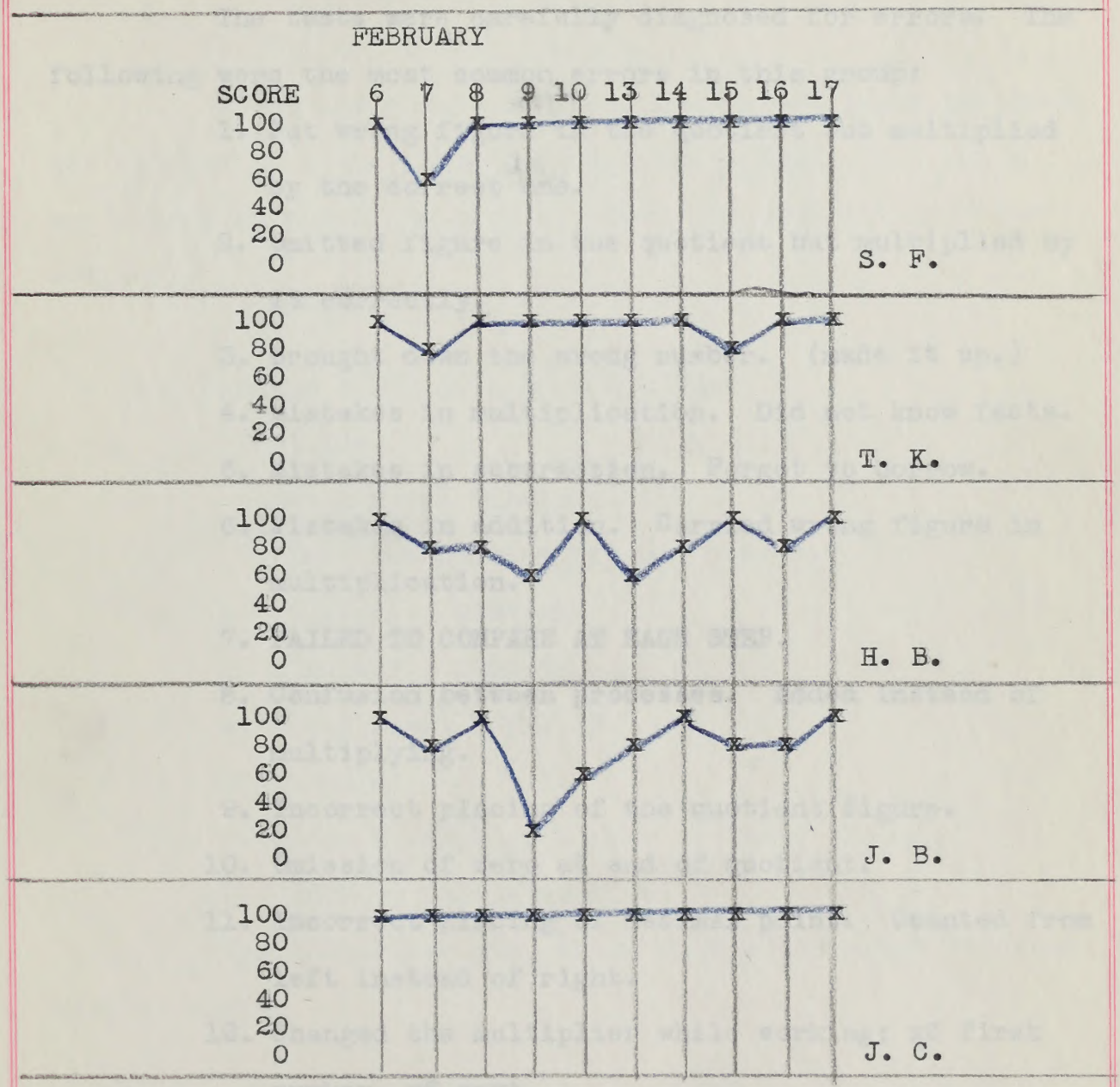
(c) CHECKING MULTIPLICATION BY DIVISION TAUGHT.

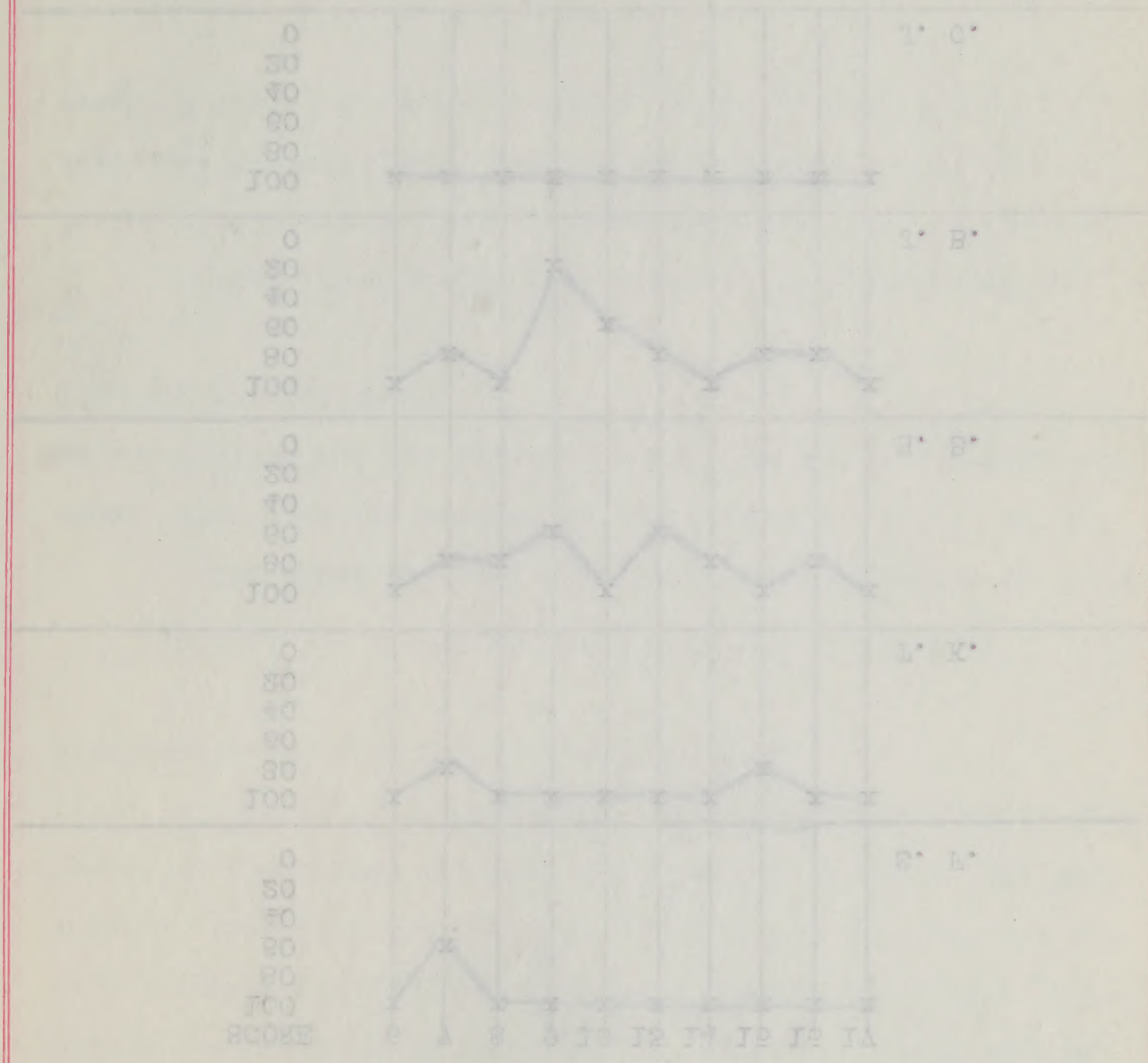
The class was taught to check multiplication by division. They used the product as the dividend, the multiplier as the divisor and the quotient should be the multiplicand if the work were correct.

Individual graphs were kept of the daily results. On the blackboard was kept a class record of 100% pupils by sex, boys against girls, and the daily totals. This was to create a little friendly rivalry. (See EXHIBIT 14).

EXHIBIT 12 MY ARITHMETIC GRAPH.

MULTIPLICATION.





5. PROCEDURE IN LONG DIVISION.

(a) DIAGNOSIS OF ERRORS COMMON TO GROUP.

The tests were carefully diagnosed for errors. The following were the most common errors in this group:

1. Put wrong figure in the quotient but multiplied by the correct one.
2. Omitted figure in the quotient but multiplied by it correctly.
3. Brought down the wrong number. (made it up.)
4. Mistakes in multiplication. Did not know facts.
5. Mistakes in subtraction. Forgot to borrow.
6. Mistakes in addition. Carried wrong figure in multiplication.
7. FAILED TO COMPARE AT EACH STEP.
8. Confusion between processes. Added instead of multiplying.
9. Incorrect placing of the quotient figure.
10. Omission of zero at end of quotient.
11. Incorrect placing of decimal point. Counted from left instead of right.
12. Changed the multiplier while working; x3 first number, x5 next.
13. Lack of knowledge of process steps.
    a. Did not know what to do when the quotient figure was too large.
    b. Did not know what to do when remainder was as large as or larger than the divisor.

c. Did not know how to use a trial divisor.

14. Did not know how to work when divisor had more than two digits in it.

15. Did not finish example.

After the errors had been determined, then the work was planned to cover these deficiencies. Each child had a small card on which the process steps for long division were written.

(b) PROCESS STEPS IN LONG DIVISION.

1. Divide.

Use a trial quotient.

Place the quotient figure properly.

2. Multiply. COMPARE.

3. Subtract. COMPARE.

4. Bring Down. COMPARE.

EXTRA STEPS.

5. Write R after remainder if there is one.

6. CHECK by multiplication.

The comparison step after each process was stressed very strongly.

(c) CHECK BY MULTIPLICATION.

To check long division they used the quotient as the multiplicand, the divisor as the multiplier, then added in any remainder, and if the work was correct, the product would be the same as the dividend.

c. Did not know how to use a trial divisor.

14. Did not know how to work when divisor had more than two digits in it.

15. Did not finish example.

After the errors had been determined, then the work was planned to cover these deficiencies. Each child had a small card on which the process steps for long division were written.

(b) PROCESS STEPS IN LONG DIVISION.

1. Divide.

Use a trial quotient.

Place the quotient figure properly.

2. Multiply. COMPARE.

3. Subtract. COMPARE.

4. Bring Down. COMPARE.

EXTRA STEPS.

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The comparison step after each process was stressed very strongly.

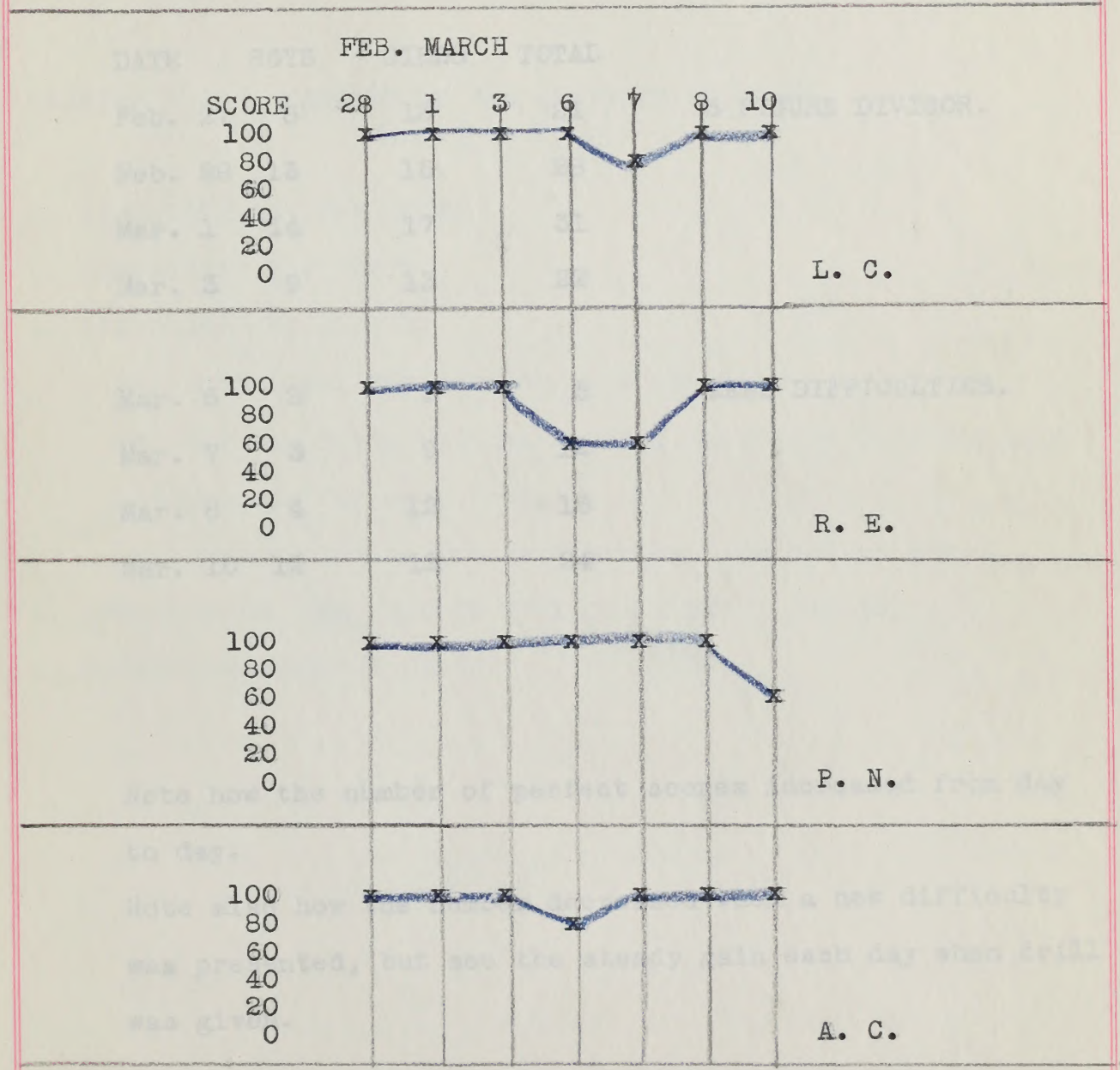
(c) CHECK BY MULTIPLICATION.

To check long division they used the quotient as the multiplicand, the divisor as the multiplier, then added in any remainder, and if the work was correct, the product would be the same as the dividend.

Every example had to be checked before it was left. This helped them to check each process for errors that they knew they were weak in before leaving the example. Five examples a day were given to be done and proved. These were planned according to difficulty and process step difficulties. Each child kept his own record of daily achievement in graphic form. (See EX. 13.) A class record of perfect scores for each day by boys and girls was kept also. (See EX. 14.)

EXHIBIT 13 MY ARITHMETIC GRAPH,

LONG DIVISION.



SAMPLES OF INDIVIDUAL RECORDS KEPT BY PUPILS.

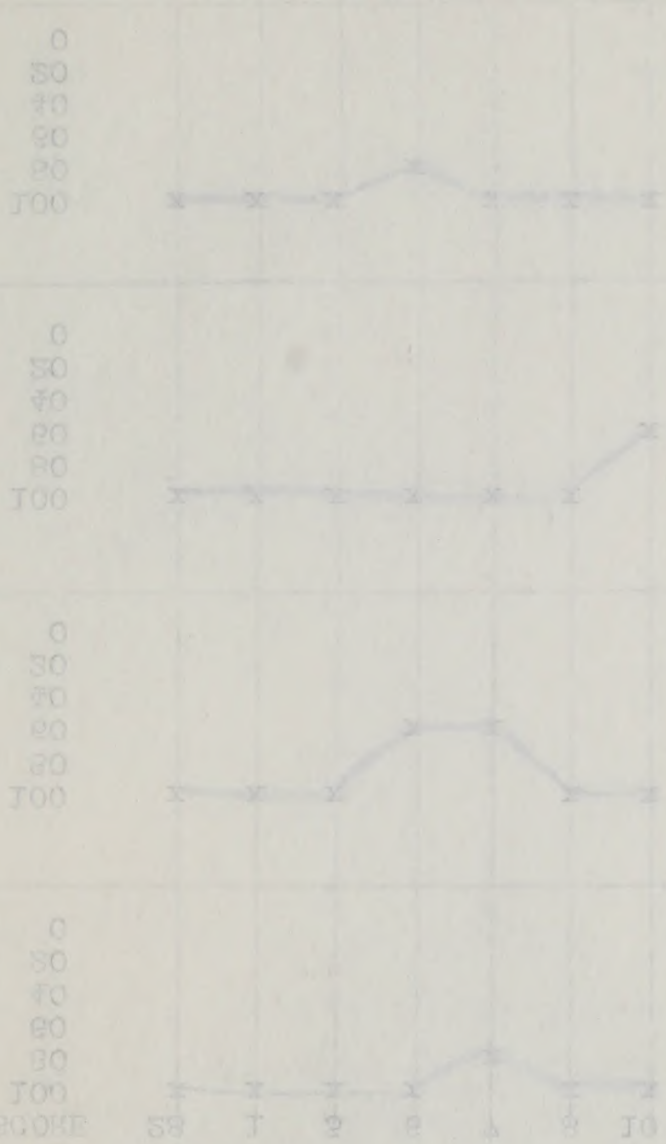


EXHIBIT 14 CLASS RECORD OF PERFECT SCORES IN DIVISION BY SEX FOR COMPETITIVE PURPOSES ONLY.

DATE	BOYS	GIRLS	TOTAL	
Feb. 27	8	13	21	3 FIGURE DIVISOR.
Feb. 28	13	15	28	
Mar. 1	14	17	31	
Mar. 3	9	13	22	
Mar. 6	2	3	5	ZERO DIFFICULTIES.
Mar. 7	3	9	12	
Mar. 8	4	12	16	
Mar. 10	12	12	24	

Note how the number of perfect scores increased from day to day.

Note also how the number decreased when a new difficulty was presented, but see the steady gain each day when drill was given.

CHAPTER V. RESULTS OF THE RE-TESTS IN MARCH.

1. ADMINISTERING THE TESTS.
2. CORRECTING THE TESTS.
3. RECORDING THE RESULTS.
   (a) Individual records for each process.
   (b) Two-Way Distributions showing SCORE and TIME for each process for each room.
   (c) Summary Tables for each process for entire group.
4. INTERPRETING THE RESULTS FROM THE SUMMARY TABLES.
5. CORRECTIVE LOAD IN MARCH.

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CHAPTER 5. RESULTS OF THE RE-TESTS IN MARCH.

1. ADMINISTERING THE TESTS.

In the middle of March the same tests were given to all the classes in the sixth grade. The same procedure was followed as in October. Each teacher gave the tests to her own class, one a day, until the set was completed. Each teacher received a sheet of instructions to be followed. (See Exhibit 15.)

2. CORRECTING THE TESTS.

The same procedure was followed in the correction of these tests as before. The writer did all of the correcting, following the same standards of accuracy as in October.

There was one difference in the RE-TESTS and that was, provision was made to keep a record of the time it took to check the work. Two classes did not record any time for checking any process. Two other classes recorded the time for checking each process. One class did not record the time for checking the multiplication process but did record for the other processes. In some instances the pupils forgot to record the time so there are some spaces in the records as shown on Tables XXXI through XXXV.

These records of time taken for checking are included here for future reference purposes, but they need a word of explanation. In one class the time for checking included the copying of the work on the reverse of the test paper which involved turning the paper for every example. Another class added each column and put the result down on the back of the paper, and this involved turning the paper every time a column was add-

CHAPTER 6. RESULTS OF THE RE-TESTS IN MARCH.

1. ADMINISTERING THE TESTS.

In the middle of March the same tests were given to all the classes in the sixth grade. The same procedure was followed as in October. Each teacher gave the tests to her own class, one a day, until the set was completed. Each teacher received a sheet of instructions to be followed. (See Exhibit 15.)

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EXHIBIT 15.

DIRECTIONS FOR RE-TESTING IN THE FUNDAMENTALS OF ARITHMETIC

Schedule of tests to be given.

MONDAY	DIVISION
TUESDAY	MULTIPLICATION
WEDNESDAY	ADDITION
THURSDAY	SUBTRACTION.

Time suggested.

Give one test a day, preferably the first thing in the morning.

Room conditions.

Keep the room quiet. Allow no distractions.

Provide some other work to keep the ones who finish quickly busy and quiet.

Equipment.

See that each pupil has two sharpened pencils ready.

Information.

The information should be filled in at the top of each test sheet very carefully. Add another line which reads: "Time for Checking minutes."

Timing of tests.

Please keep an accurate account of the time in minutes necessary to complete the test. Allow each pupil time to finish each test.

EXHIBIT 16.

DIRECTIONS FOR RE-TESTING IN THE FUNDAMENTALS OF ARITHMETIC

Schedule of tests to be given.

MONDAY DIVISION

TUESDAY MULTIPLICATION

WEDNESDAY ADDITION

THURSDAY SUBTRACTION.

Time suggested.

Give one test a day, preferably the first thing in the morning.

Room conditions.

Keep the room quiet. Allow no distractions.

Provide some other work to keep the ones who finish quickly busy and quiet.

Equipment.

See that each pupil has two sharpened pencils ready.

Information.

The information should be filled in at the top of each test sheet very carefully. Add another line which reads: "Time for Checking minutes."

Timing of tests.

Please keep an accurate account of the time in minutes necessary to complete the test. Allow each pupil time to finish each test.

IMPORTANT ! ! !

If you have taught your class to check their work before leaving it, please ask them to do all the examples first, and record the time it took them to do them all. Then have them go back immediately and check their work, recording the time it took for checking.

This instruction must be carefully understood by pupils or it will not be possible to compare results with the October Tests.

If you have not taught checking, say nothing about it.

AIM.

Each child is to try for 100%. We hope there will be many this time. We also hope each child will improve his marks over the ones obtained in October.

Collecting tests.

Please collect all tests and send them to me after each test has been completed.

Thank you one and all for your fine cooperation.

IMPORTANT ! ! !

If you have taught your class to check their work before leaving it, please ask them to do all the examples first, and record the time it took them to do them all. Then have them go back immediately and check their work, recording the time it took for checking.

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Collecting tests.

Please collect all tests and send them to me after each test has been completed.

Thank you one and all for your fine cooperation.

ed. Thus more time is shown than was actually consumed by the checking process. The check for multiplication was division and as the latter takes longer for the pupils to do, more time was taken for checking than for doing the test. This seems to indicate that a simpler method for checking multiplication should be taught. The same is true for long division. In some instances the writer is sure that the instructions were not clear to the pupils and they included the time for both doing and checking in the one time as that was the only time given on their paper. So that in the comparisons made at the end of this study the time for checking has been ignored.

3. RECORDING THE RESULTS.

The results were recorded in the same manner as in the INITIAL TEST in October except that the time for checking the examples is included, if it was given.

(a) Individual records were kept for each pupil in each process, including Score and Time on each of the four process tests, and the time taken for checking. (See Tables XXXI through XXXV.)

(b) Two Way Distributions were made showing Score and Time for each of the five rooms in each process, making 20 tables. (See Tables XXXVI through XL, Tables XLII through XLVI, Tables XLVIII through LII, and Tables LIV through LVIII.)

(c) Summary Tables were made for each process for the entire group. (See Tables XLI, XLVII, LIII, and LIX.)

Table XXXI Showing Individual Records of pupils in Room L including Score and Time on each of the four process tests on the Re-testing in March, and time taken to check three tests.

Pupil	A. P. S %	A. P. T Min.	A. P. Ck.	S. P. S %	S. P. T Min.	S. P. Ck.	M. P. S %	M. P. T Min.	M. P. CK.	L. D. P. S %	L. D. P. T Min.	L. D. P. Ck.
1	100	5	11	100	5	17	88	9		84	14	19
2	84	9	9	92	7	15	88	9		80	17	17
3	100	11	13	100	7	13	92	10		100	21	15
4	96	15	11	96	11	-	76	18		84	33	38
5	92	11	12	96	7	28	88	16		absent		
6	92	12	10	96	6	11	76	13		92	18	16
7	88	21	4	96	7	28	68	12		84	29	33
8	96	10	10	100	6	18	80	12		92	16	20
9	88	21	10	48	10	20	48	14		16	26	30
10	88	11	8	88	7	12	76	9		60	21	17
11	88	20	6	absent			72	27		56	44	35
12	64	10	3	88	7	17	60	10		84	17	20
13	88	9	15	100	8	17	72	13		72	28	21
14	88	16	13	100	7	18	68	12		24	36	20
15	100	5	9	100	6	11	72	7		84	19	16
16	92	13	16	84	10	13	80	11		92	23	17
17	88	10	6	88	7	22	76	9		100	19	22
18	96	20	4	100	9	16	68	12		absent		
19	(left)											
20	92	11	16	92	10	11	80	12		88	15	19
21	100	11	15	100	7	23	92	14		88	20	30
22	88	15	5	100	9	17	80	14		92	21	23
23	92	18	6	84	12	15	84	18		84	24	19
24	88	8	12	92	7	16	76	10		88	32	19
25	92	18	7	80	8	24	80	16		68	25	23
26	96	5	7	100	6	17	84	9		96	19	17
27	88	9	11	100	7	-	absent			96	19	16
28	88	10	14	80	8	19	72	15		92	19	19
29	88	17	10	absent			84	16		96	19	23
30	56	26	12	88	10	22	40	25		12	48	28
31	absent			absent			88	14		88	20	19
32	100	9	15	96	9	20	absent			96	18	19
33	96	8	7	96	6	21	88	10		92	18	16
34	100	13	12	100	9	17	absent			absent		
35	96	9	6	96	6	18	92	9		84	14	15
36	absent			absent			absent			88	22	24
37	100	5	12	100	6	18	100	10		96	16	17
38	100	7	12	100	6	16	96	10		100	20	14
39	92	5	10	92	5	13	84	6		80	15	18
40	absent			absent			84	14		88	22	21
41(new)	96	10	3	84	10	24	76	16		64	31	28
Total Pupils Tested	37			35			36			37		

Note: No time for checking the M. P. Test was recorded.

Table XXXI Showing Individual Records of pupils in Room 5 including Score and Time on each of the four process tests on the Re-testing in March, and time taken to check three tests.

Pupil	A. P. S %	A. P. T Min.	A. P. Ck.	S. P. S %	S. P. T Min.	S. P. Ck.	M. P. S %	M. P. T Min.	M. P. Ck.	L. D. P. S %	L. D. P. T Min.	L. D. P. Ck.
1	100	5	11	100	5	17	88	9		84	14	19
2	84	9	9	92	7	15	88	9		80	17	17
3	100	11	13	100	7	13	92	10		100	21	15
4	96	15	11	96	11	-	76	18		84	33	38
5	92	11	12	96	7	88	88	16		absent		
6	92	12	10	96	6	11	76	15		92	18	16
7	88	21	4	96	7	28	68	12		84	29	33
8	96	10	10	100	6	18	80	12		92	16	20
9	88	21	10	48	10	20	48	14		16	26	30
10	88	11	8	88	7	12	76	9		60	21	17
11	88	20	6	absent			72	27		56	44	35
12	64	10	3	88	7	17	60	10		84	17	20
13	88	9	15	100	8	17	72	13		72	28	21
14	88	16	13	100	7	18	68	12		24	36	20
15	100	5	9	100	6	11	72	7		84	19	16
16	92	13	16	84	10	13	80	11		92	23	17
17	88	10	6	88	7	22	76	9		100	19	22
18	96	20	4	100	9	16	68	12		absent		
19 (left)												
20	92	11	16	92	10	11	80	12		88	15	19
21	100	11	15	100	7	23	92	14		88	20	30
22	88	15	5	100	9	17	80	14		92	21	23
23	92	18	6	84	12	15	84	18		84	24	19
24	88	8	18	92	7	16	76	10		88	32	19
25	92	18	7	80	8	24	80	16		68	25	23
26	96	5	7	100	6	17	84	9		96	19	17
27	88	9	11	100	7	-	absent			96	19	16
28	88	10	14	80	8	19	72	13		92	19	19
29	88	17	10	absent			84	16		96	19	23
30	56	26	12	88	10	22	40	25		12	48	28
31	absent			absent			88	14		88	20	19
32	100	9	15	96	9	20	absent			96	18	19
33	96	8	7	96	6	21	88	10		92	18	16
34	100	13	12	100	9	17	absent			absent		
35	96	9	6	96	6	18	92	9		84	14	15
36	absent			absent			absent			88	22	24
37	100	5	12	100	6	18	100	10		96	16	17
38	100	7	12	100	6	16	96	10		100	20	14
39	92	5	10	92	5	13	84	6		80	15	18
40	absent			absent			84	14		88	22	21
41(new)	96	10	3	84	10	24	76	16		64	31	28
Total Pupils Tested	37			35			36			37		

Note: No time for checking the M. P. Test was recorded.

Table XXXII Showing Individual Records of pupils in Room W including Score and Time on each of the four process tests on the Re-testing in March.

Pupil	A. P. S %	A. P. T Min.	A. P. Ck.	S. P. S %	S. P. T Min.	S. P. Ck.	M. P. S %	M. P. T Min.	M. P. Ck.	L. D. P. S %	L. D. P. T Min.	L. D. P. Ck.
1	68	9		88	7		64	9		44	30	
2	92	4		80	4		80	10		84	15	
3	92	10		100	6		84	10		84	18	
4	84	7		76	15		72	11		84	30	
5	92	10		76	10		32	18		24	20	
6	92	7		80	6		56	10		72	30	
7	76	10		72	8		64	18		68	30	
8	84	13		100	7		72	10		96	21	
9	92	7		88	5		72	11		84	14	
10	88	7		92	7		76	21		92	26	
11	92	6		92	5		72	9		84	25	
12	80	17		92	13		80	15		80	55	
13	88	13		100	8		76	14		92	18	
14	88	6		80	13		64	17		84	50	
15	100	7		92	5		56	10		64	35	
16	80	9		92	3		80	10		88	20	
17	100	6		92	5		72	7		84	21	
18	92	12		92	13		92	18		100	18	
19	92	10		absent			68	15		88	35	
20	100	6		96	6		84	9		92	24	
21	92	8		72	12		36	20		0	15	
22	84	6		92	6		64	6		68	10	
23	84	7		100	4		84	12		100	15	
24	96	10		96	9		absent			absent		
25	100	6		88	4		92	9		96	17	
26	92	10		absent			68	15		92	25	
27	100	7		100	5		absent			absent		
28	88	7		100	4		60	16		absent		
29	88	6		100	5		88	10		80	30	
30	96	9		96	6		88	20		absent		
31	100	8		96	5		100	11		100	11	
32	88	10		92	5		76	10		68	35	
33	68	15		84	5		68	12		64	26	
34	92	9		92	5		84	10		100	15	
35	92	6		96	4		88	7		88	15	
36	76	10		100	5		68	10		88	15	
37	92	7		84	5		88	10		96	20	
38	84	9		100	5		88	9		92	18	
39(new)	92	6		80	11		84	10		36	22	
Total Pupils Tested	39			37			37			35		

Note: No time for checking was recorded by this class.

Table XXXII Showing Individual Records of pupils in Room W including Score and Time on each of the four process tests on the Re-testing in March.

Pupil	A. P. S %	A. P. T Ck. Min.	S. P. S %	S. P. T Ck. Min.	M. P. S %	M. P. T Ck. Min.	L. D. P. S %	L. D. P. T Ck. Min.
1	68	9	88	7	64	9	44	30
2	92	4	80	4	80	10	84	15
3	92	10	100	6	84	10	84	18
4	84	7	76	15	72	11	84	30
5	92	10	76	10	32	18	24	20
6	92	7	80	6	56	10	72	30
7	76	10	72	8	64	18	68	30
8	84	15	100	7	72	10	96	21
9	92	7	88	5	72	11	84	14
10	88	7	92	7	76	21	92	26
11	92	6	92	6	72	9	84	25
12	80	17	92	13	80	15	80	55
13	88	13	100	8	76	14	92	18
14	88	6	80	13	64	17	84	30
15	100	7	92	5	56	10	64	35
16	80	9	92	5	80	10	88	20
17	100	6	92	5	72	7	84	21
18	92	12	92	13	92	18	100	18
19	92	10	absent		68	15	88	35
20	100	6	96	6	84	9	92	24
21	92	8	72	12	36	20	0	15
22	84	6	92	6	64	6	68	10
23	84	7	100	4	84	12	100	15
24	96	10	96	9	absent		absent	
25	100	6	88	4	92	9	96	17
26	92	10	absent		68	15	92	25
27	100	7	100	5	absent		absent	
28	88	7	100	4	60	16	absent	
29	88	6	100	5	88	10	80	30
30	96	9	96	6	88	20	absent	
31	100	8	96	5	100	11	100	11
32	88	10	92	5	76	10	68	35
33	68	15	84	5	68	12	64	26
34	92	9	92	5	84	10	100	15
35	92	6	96	4	88	7	88	15
36	76	10	100	5	68	10	88	15
37	92	7	84	5	88	10	96	20
38	84	9	100	5	88	9	92	18
39(new)	92	6	80	11	84	10	36	22
Total Pupils Tested	38		37		37		35	

Note: No time for checking was recorded by this class.

Table XXXIII Showing Individual Records of pupils in Room J including Score and Time on each of the four process tests on the Re-testing in March, and time taken to check each test.

Pupil	A. P. S %	A. P. T Min.	A. P. Ck.	S. P. S %	S. P. T Min.	S. P. Ck.	M. P. S %	M. P. T Min.	M. P. Ck.	L. D. P. S %	L. D. P. T Min.	L. D. P. Ck.
1	92	5	5	96	3	4	92	6	15	100	8	13
2	96	9	13	100	5	6	76	12	25	88	23	-
3	96	13	36	96	9	8	80	14	-	88	35	-
4	84	22	27	88	17	-	80	18	-	absent		
5	84	11	17	100	6	9	92	10	35	100	13	15
6	100	7	20	88	7	7	96	10	30	88	23	-
7	88	7	24	100	7	9	100	7	29	100	21	15
8	96	7	8	100	8	4	84	10	46	92	21	20
9	76	13	8	88	9	11	72	13	44	76	26	25
10	100	5	-	100	4	5	88	7	-	84	13	-
11	96	11	7	100	5	8	absent			96	11	-
12	96	7	8	80	5	10	100	10	30	92	20	20
13	88	7	23	100	7	7	60	8	-	92	8	-
14	88	12	18	100	7	6	96	11	44	88	24	21
15	72	14	25	100	11	11	60	16	-	64	35	-
16	96	7	11	96	4	3	76	9	22	96	13	19
17	88	9	13	92	6	-	64	8	-	60	20	21
18	96	6	12	96	4	5	92	7	14	100	13	14
19	100	5	12	100	4	7	100	7	20	100	12	12
20	80	7	20	absent			84	11	30	92	21	17
21	100	6	10	100	5	5	92	10	29	100	13	15
22	100	6	16	100	5	11	96	9	26	96	13	18
23	100	9	8	92	7	7	80	13	-	88	23	-
24	92	7	15	100	5	4	76	14	36	76	30	-
25	100	7	25	100	6	6	100	12	33	100	21	20
26	100	13	17	92	5	-	88	11	41	100	20	19
27	96	6	8	100	4	7	92	8	28	88	10	-
28	72	7	24	76	4	5	88	10	8	100	13	19
29	92	7	25	100	9	8	84	12	15	72	30	-
30	80	15	21	76	11	7	84	8	-	absent		
31	absent			absent			92	18	27	100	17	11
32	100	10	10	100	7	10	100	13	13	76	24	-
33	92	12	23	100	6	13	80	12	30	88	20	20
34	100	11	15	100	6	10	92	15	37	100	22	-
35	100	7	9	100	6	5	88	10	16	100	17	20
36	100	5	18	100	5	13	84	12	-	92	20	26
37	100	11	32	96	6	-	96	11	-	92	17	-
38	100	10	13	100	6	9	100	11	26	100	13	15
39(new)	84	18	15	92	6	5	88	12	50	92	18	18
Total Pupils Tested	38			37			38			37		

Note: Some pupils forgot to record time for checking some tests.

Table XXXIII Showing Individual Records of pupils in Room 7 including Score and Time on each of the four process tests on the Re-testing in March, and time taken to check each test.

Pupil	A. P. S %	A. P. T Min.	A. P. Ck.	S. P. S %	S. P. T Min.	S. P. Ck.	M. P. S %	M. P. T Min.	M. P. Ck.	L. D. P. S %	L. D. P. T Min.	L. D. P. Ck.
1	92	5	5	96	3	4	92	6	15	100	8	13
2	96	9	13	100	5	6	76	12	25	88	23	-
3	96	13	36	96	9	8	80	14	-	88	35	-
4	84	22	27	88	17	-	80	18	-	absent		
5	84	11	17	100	6	9	92	10	35	100	13	15
6	100	7	20	88	7	7	96	10	30	88	23	-
7	88	7	24	100	7	9	100	7	29	100	21	15
8	96	7	8	100	8	4	84	10	46	92	21	20
9	76	13	8	88	9	11	72	13	44	76	26	25
10	100	5	-	100	4	5	88	7	-	84	13	-
11	96	11	7	100	5	8	absent			96	11	-
12	96	7	8	80	5	10	100	10	30	92	20	20
13	88	7	23	100	7	7	60	8	-	92	8	-
14	88	12	18	100	7	6	96	11	44	88	24	21
15	72	14	25	100	11	11	60	16	-	64	35	-
16	96	7	11	96	4	3	76	9	22	96	13	19
17	88	9	15	92	6	-	64	8	-	60	20	21
18	96	6	12	96	4	5	92	7	14	100	13	14
19	100	5	12	100	4	7	100	7	20	100	12	12
20	80	7	20	absent			84	11	30	92	21	17
21	100	6	10	100	5	5	92	10	29	100	13	15
22	100	6	16	100	5	11	96	9	26	96	15	18
23	100	9	8	92	7	7	80	13	-	88	23	-
24	92	7	15	100	5	4	76	14	36	76	30	-
25	100	7	25	100	6	6	100	12	33	100	21	20
26	100	13	17	92	5	-	88	11	41	100	20	19
27	96	6	8	100	4	7	92	8	26	88	10	-
28	72	7	24	76	4	5	88	10	8	100	13	19
29	92	7	25	100	9	8	84	12	15	72	30	-
30	80	15	21	76	11	7	84	8	-	absent		
31	absent			absent			92	18	27	100	17	11
32	100	10	10	100	7	10	100	13	13	76	24	-
33	92	12	23	100	6	13	80	12	30	88	20	20
34	100	11	15	100	6	10	92	15	37	100	22	-
35	100	7	9	100	6	5	88	10	16	100	17	20
36	100	5	18	100	5	13	84	12	-	92	20	26
37	100	11	32	96	6	-	96	11	-	92	17	-
38	100	10	13	100	6	9	100	11	26	100	13	15
39(new)	84	18	15	92	6	5	88	12	50	92	18	18
Total Pupils Tested	38			37			38			37		

Note: Some pupils forgot to record time for checking some tests.

Table XXXIV Showing Individual Records of pupils in Room H including Score and Time on each of the four process tests on the Re-testing in March.

Pupil	A. P. S %	A. P. T Min.	A. P. Ck.	S. P. S %	S. P. T Min.	S. P. Ck.	M. P. S %	M. P. T Min.	M. P. Ck.	L. D. P. S %	L. D. P. T Min.	L. D. P. Ck.
1	92	5		96	4		72	7		76	15	
2	84	11		96	6		88	15		88	24	
3	96	13		96	11		76	18		88	26	
4	96	12		64	9		68	7		88	27	
5	76	12		92	8		80	14		88	30	
6	absent			absent			72	10		92	19	
7	absent			absent			80	7		92	15	
8	absent			absent			96	6		100	10	
9	80	9		80	7		60	7		68	19	
10	96	13		36	9		92	10		76	32	
11	92	12		100	7		100	12		96	27	
12	absent			absent			absent			96	12	
13	72	4		8	5		12	15		16	18	
14	96	5		88	8		80	14		100	17	
15	92	7		96	7		92	10		28	34	
16	92	12		100	7		80	10		100	15	
17	92	12		96	10		88	11		88	24	
18	92	7		100	5		72	9		84	13	
19	absent			absent			absent			absent		
20	absent			absent			absent			absent		
21	100	6		100	6		84	11		100	14	
22	100	14		96	6		76	14		88	23	
23	absent			absent			absent			72	22	
24	absent			absent			absent			absent		
25	100	7		100	5		92	6		96	13	
26	100	5		96	5		88	10		100	14	
27	96	20		88	7		84	15		96	40	
28	absent			100	7		80	10		100	17	
29	92	14		absent			absent			absent		
30	100	5		100	7		92	9		96	21	
31	84	5		100	5		92	9		96	10	
32	96	7		100	6		96	7		100	15	
33	88	10		72	7		84	12		84	20	
34	96	15		96	9		88	12		96	18	
35	88	16		96	6		88	12		92	23	
36	96	7		100	10		absent			96	23	
37	76	5		80	4		84	7		100	9	
38	100	12		88	7		88	16		96	13	
39	84	20		96	11		68	14		96	17	
Total Pupils Tested	30			30			32			35		

Note: No time for checking was recorded by this class.

Table XXXIV Showing Individual Records of pupils in Room H including Score and Time on each of the four process tests on the Re-testing in March.

Pupil	A. P. S %	A. P. T Min.	S. P. S %	S. P. T Min.	M. P. S %	M. P. T Min.	L. D. P. S %	L. D. P. T Min.
1	92	5	96	4	72	7	76	15
2	84	11	96	6	88	15	88	24
3	96	13	96	11	76	18	88	26
4	96	12	64	9	68	7	88	27
5	76	12	92	8	80	14	88	30
6	absent		absent		72	10	92	19
7	absent		absent		80	7	92	15
8	absent		absent		96	6	100	10
9	80	9	80	7	60	7	68	19
10	96	13	36	9	92	10	73	32
11	92	12	100	7	100	12	96	27
12	absent		absent		absent		96	12
13	72	4	8	5	12	15	16	18
14	96	5	88	8	60	14	100	17
15	92	7	96	7	92	10	28	34
16	92	12	100	7	80	10	100	15
17	92	12	96	10	88	11	88	24
18	92	7	100	5	72	9	84	13
19	absent		absent		absent		absent	
20	absent		absent		absent		absent	
21	100	6	100	6	84	11	100	14
22	100	14	96	6	76	14	88	23
23	absent		absent		absent		72	22
24	absent		absent		absent		absent	
25	100	7	100	5	92	6	96	13
26	100	5	96	5	88	10	100	14
27	96	20	88	7	84	15	96	40
28	absent		100	7	80	10	100	17
29	92	14	absent		absent		absent	
30	100	5	100	7	92	9	96	21
31	84	5	100	5	92	9	96	10
32	96	7	100	6	96	7	100	15
33	88	10	72	7	84	12	84	20
34	96	15	96	9	88	12	96	18
35	88	16	96	6	88	12	92	23
36	96	7	100	10	absent		96	23
37	76	5	80	4	84	7	100	9
38	100	12	88	7	88	16	96	13
39	84	20	96	11	68	14	96	17
Total Pupils Tested	30		30		32		35	

Note: No time for checking was recorded by this class.

Table XXXV Showing Individual Records of pupils in Room R including Score and Time on each of the four process tests on the Re-testing in March, and time taken for checking each test.

Pupil	A. P. S %	A. P. T Min.	A. P. Ck.	S. P. S %	S. P. T Min.	S. P. Ck.	M. P. S %	M. P. T Min.	M. P. Ck.	L. D. P. S %	L. D. P. T Min.	L. D. P. Ck.
1	100	6	6	100	3	5	100	5	19	100	8	12
2	96	10	4	92	12	4	absent			absent		
3	92	12	12	100	8	8	64	9	36	100	18	26
4	100	12	12	100	8	8	96	12	23	100	18	28
5	100	8	11	96	11	2	96	12	33	92	16	25
6	100	7	8	100	4	6	96	7	23	96	15	20
7	84	9	4	88	5	6	84	9	26	88	18	17
8	88	9	4	92	9	2	absent			absent		
9	96	8	10	96	4	2	96	8	36	100	10	23
10	92	7	20	100	4	4	100	7	17	100	10	14
11	100	10	4	100	5	2	96	9	36	88	17	22
12	100	16	2	88	14	5	92	12	31	76	23	24
13	84	12	4	absent			100	12	33	96	27	20
14	100	6	9	100	5	5	96	7	17	100	10	14
15	88	12	3	96	11	6	96	12	33	84	27	20
16	80	6	3	68	4	2	92	8	37	88	15	14
17	92	8	10	96	4	3	96	9	21	76	15	18
18	80	8	5	76	4	2	80	8	34	92	20	25
19	72	15	17	92	4	8	80	9	12	96	9	20
20	76	5	3	92	2	4	88	5	18	92	11	10
21	100	6	8	100	6	4	96	6	16	56	41	25
22	92	13	12	92	6	17	88	10	35	96	16	30
23	96	12	4	100	7	7	80	10	35	88	25	22
24	80	5	7	92	8	5	92	10	35	84	19	20
25	80	9	2	56	5	2	80	10	34	88	20	20
26	100	8	3	96	4	2	96	9	33	100	16	17
27	100	9	9	68	10	6	56	14	17	36	22	18
28	96	6	10	96	4	4	92	8	35	96	16	19
29	100	12	4	88	8	4	88	10	35	84	14	23
30	84	10	5	88	7	2	96	12	24	92	18	22
31	92	7	15	100	4	9	88	7	23	96	14	15
32	96	8	3	84	9	2	76	10	25	88	16	20
33	96	22	4	80	9	2	absent			52	18	20
34	100	7	6	96	5	3	92	11	34	88	20	25
35	absent			absent			absent			88	20	27
36	96	8	11	84	7	3	52	15	26	84	17	22
37 (left)												
38 (left)												
39 (left)												
40(new)	96	14	3	absent			80	12	33	80	17	25
Total Pupils Tested	36			34			33			35		

Table XXXV Showing Individual Records of pupils in Room B in-cluding Score and Time on each of the four Processes on the Re-testing in March, and time taken for erecting each test.

Pupil	A. P. S	A. P. T	A. P. Cr.	S. P. S	S. P. T	S. P. Cr.	M. P. S	M. P. T	M. P. Cr.	D. P. S	D. P. T	D. P. Cr.
	%	Min.		%	Min.		%	Min.		%	Min.	
1	100	8	6	100	8	5	100	5	19	100	8	12
2	96	10	4	92	12	4	absent			absent		
3	92	12	12	100	8	8	84	9	36	100	18	26
4	100	12	12	100	8	8	96	12	23	100	18	28
5	100	8	11	96	11	2	96	12	35	92	16	25
6	100	7	8	100	4	6	96	7	23	96	15	20
7	84	9	4	88	8	6	84	9	26	88	18	17
8	88	9	4	92	9	2	absent			absent		
9	96	8	10	96	4	2	96	8	36	100	10	22
10	88	7	20	100	4	4	100	7	17	100	10	14
11	100	10	4	100	6	2	96	9	36	88	17	22
12	100	18	8	88	14	6	92	12	31	76	25	24
13	84	12	4	absent			100	12	35	96	27	20
14	100	8	8	100	6	6	96	7	17	100	10	14
15	88	12	8	88	11	8	96	12	35	84	27	20
16	80	8	8	96	4	2	92	8	37	88	15	14
17	92	8	10	96	4	6	96	9	21	76	15	18
18	80	8	8	76	4	2	80	8	24	92	20	26
19	72	18	17	92	4	8	80	9	12	96	9	20
20	76	8	8	88	8	4	88	8	18	92	11	10
21	100	8	8	100	6	4	96	8	16	86	41	26
22	92	12	12	92	6	17	88	10	36	96	16	20
23	96	12	4	100	7	7	80	10	36	88	25	22
24	80	8	7	92	8	6	92	10	35	84	16	20
25	80	9	2	96	8	2	80	10	24	88	20	20
26	100	8	8	96	4	2	96	9	33	100	16	17
27	100	9	9	88	10	6	88	14	17	86	22	18
28	96	8	10	96	4	4	92	8	33	96	16	18
29	100	12	4	88	8	4	88	10	36	84	14	26
30	84	10	8	88	7	2	88	12	24	92	18	22
31	92	7	16	100	4	8	88	7	23	96	14	16
32	96	8	8	84	8	2	76	10	26	88	16	20
33	96	22	4	80	9	2	absent			82	18	20
34	100	7	6	96	5	5	92	11	24	88	20	26
35	absent			absent			absent			88	20	27
36	96	8	11	84	7	3	82	18	26	84	17	22
37 (left)												
38 (left)												
39 (left)												
40(new)36	14	3	absent				80	12	35	80	17	25
Total Pupils Tested 36			24			25			36			

4. INTERPRETING THE RESULTS FROM THE SUMMARY TABLES.

Since the same method of recording the results was followed in the RE-TEST as in the INITIAL testing, it will be necessary only to interpret the summary tables.

The summary tables for the A. P. Re-TEST is table XLI. This table shows that out of the 180 pupils taking the test 46 obtained a perfect score. However, of this 46 only 29 or 16.24% were up to both accuracy and time standards and so could be excused from further drill, while 151 pupils or 83.76% of them still need corrective work in addition. The range in score was from 100% to 56%, and the range in time was from 4 to 26 minutes. The median score was 92% and the median time was 9 minutes. The mean score was 91.33% and the mean time was 9.82 minutes.

The summary table for subtraction is table XLVII. This table shows that out of 173 pupils taking the test 65 obtained a perfect score. However, out of these 65 only 59 pupils or 34.22% were up to both accuracy and time standards and so could be excused from further drill on subtraction. The range in score was from 100% to 8%, and the range in time was from 2 to 17 minutes. The median score was 96% and median time was 6 minutes. The mean score was 93.19% and the mean time was 6.87 minutes. Thus 114 pupils or 65.78% still need corrective work in subtraction.

The summary table for multiplication is table LIII. This table shows that out of 176 pupils taking the test 12 obtained a perfect score, However, out of this 12 only 11 pupils or 6.27% were up to both accuracy and time standards and so

4. INTERPRETING THE RESULTS FROM THE SUMMARY TABLES.

Since the same method of recording the results was followed in the RE-TEST as in the INITIAL testing, it will be necessary only to interpret the summary tables.

The summary tables for the A. P. Re-TEST is table XII.

This table shows that out of the 180 pupils taking the test 46 obtained a perfect score. However, of this 46 only 29 or 16.8% were up to both accuracy and time standards and so could be excused from further drill, while 151 pupils or 83.7% of them still need corrective work in addition. The range in score was from 100% to 68%, and the range in time was from 4 to 26 minutes. The median score was 92% and the median time was 9 minutes. The mean score was 91.83% and the mean time was 9.82 minutes.

The summary table for subtraction is table XIVII. This table shows that out of 173 pupils taking the test 55 obtained a perfect score. However, out of these 55 only 39 pupils or 22.5% were up to both accuracy and time standards and so could be excused from further drill on subtraction. The range in score was from 100% to 8%, and the range in time was from 2 to 17 minutes. The median score was 98% and median time was 8 minutes. The mean score was 95.12% and the mean time was 6.87 minutes. Thus 114 pupils or 65.78% still need corrective work in subtraction.

The summary table for multiplication is table LIII.

This table shows that out of 170 pupils taking the test 12 obtained a perfect score. However, out of this 12 only 11 pupils or 6.47% were up to both accuracy and time standards and so

Table XXXVI Showing distribution of Scores and Time made by pupils of Room L on A. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in%	5	7	8	9	10	11	12	13	15	16 to 26	Totals	Percentage at each point
100	3	1		1		2		1			8	21.60
96	1		1	1	2				1	1	7	18.90
92	1					2	1	1		2	7	18.90
88			1	2	2	1			1	5	12	32.40
84				1							1	2.70
80												
76												
72												
68												
64					1						1	2.70
60												
56										1	1	2.70
	5	1	2	5	5	5	1	2	2	9	37	99.90

	Score	Time
Median	92%	11 Minutes
Q1	92%	9 "
Q3	96%	15 "
Mean	91.24%	11.97 Minutes

Pupils up to accuracy and time standards 4 or 10.80%

Table XXXVII Showing distribution of Scores and Time made by pupils of Room W on A. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	4	6	7	8	9	10	11	13	15	17	Totals	Percentage at each point
100		3	2	1							6	15.36
96					1	1					2	5.12
92	1	3	3	1	1	4	1				14	35.84
88		2	2			1		1			6	15.36
84		1	2		1			1			5	12.80
80					1					1	2	5.12
76						2					2	5.12
72												
68					1				1		2	5.12
	1	9	9	2	5	8	1	2	1	1	39	99.84

	Score	Time
Median	92%	8 Minutes
Q1	84%	6 "
Q3	92%	10 "
Mean	90.10	8.49 Minutes

Pupils up to accuracy and time standards 6 or 15.36%

Table XXXVII. Showing distribution of Scores and Time made by pupils of Room W on Ex. E. Re-test given in March.

Scores are given in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES																Totals	Percentage at each point
	1m	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
100				3	2	1											6	16.36
96							1	1									2	6.12
92		1	3	3	1	1	4		1								14	38.24
88			2		3		1				1						6	16.36
84			1	2		1				1							6	12.80
80					1									1			2	6.12
76								2									2	5.12
72																		
68							1						1				2	5.12
	1	0	0	5	3	2	6	3	1	1	1	0	1	1	0	0	36	99.84

	Score	Time
Median	95%	8 Minutes
Q1	84%	8 "
Q3	96%	10 "
Mean	90.10	8.49 Minutes

Pupils up to accuracy and time standards 6 or 16.36%

Table XXXVIII Showing distribution of Scores and Time made by pupils of Room J on A. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	5	6	7	9	10	11	12	13	14	15 to 22	Totals	Percentage at each point
100	3	2	3	1	2	2		1			14	35.84
96		2	3	1		1		1			8	21.04
92	1		2				1				4	10.52
88			2	1			1				4	10.52
84						1				2	3	7.89
80			1							1	2	5.26
76								1			1	2.63
72			1						1		2	5.26
	4	4	12	3	2	4	2	3	1	3	38	98.96

	Score	Time
Median	96%	7 Minutes
Q1	92%	7 "
Q3	100%	11 "

Mean 92.63% 9.23 Minutes

Pupils up to accuracy and time standards 8 or 21.04%

Table XXXVIII Showing distribution of Scores and Time made by pupils of Room J on A. P. Reading Test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES																Percentage at each point
in %	5	6	7	8	9	10	11	12	13	14	15 to 22	Totals					
100	3	2	3	1	2		2		1			14					36.84
96		2	3	1			1		1			8					21.04
92	1		2					1				4					10.52
88			2		1			1				4					10.52
84							1				2	3					7.89
80			1								1	2					5.26
76									1			1					2.63
72			1							1		2					5.26
	4	4	12	2	3	2	4	2	2	1	3	38					98.56

	Score	Time
Median	96%	7 Minutes
Q1	92%	7 "
Q3	100%	11 "

Mean 93.65% 8.23 Minutes

Pupils up to accuracy and time standards 6 or 21.04%

Table XXXIX Showing distribution of Score and Time made by pupils of Room H on A. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	4	5	6	7	9	10	11	12	13	14 to 20	Totals	Percentage at each point
100		2	1	1				1		1	6	19.98
96		1		2				1	2	2	8	26.64
92		1		2				3		1	7	23.31
88						1				1	2	6.66
84		1					1			1	3	9.99
80					1						1	3.33
76		1						1			2	6.66
72	1										1	3.33
	1	6	1	5	1	1	1	6	2	6	30	99.90

	Score	Time
Median	92%	10 Minutes
Q1	84%	6 "
Q3	96%	12 "
Mean	91.46%	10.06 Minutes

Pupils up to accuracy and time standards 4 or 13.32%

Table XXXIX. Showing distribution of Score and Time made by pupils of Room B on A. E. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

| SCORES | TIME IN MINUTES | | |

Table XL Showing distribution of Scores and Time made by pupils of Room R on A. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	5	6	7	8	9	10	12	13	14	15 to 22	Totals	Percentage at each point
100		3	2	2	1	1	2			1	12	33.36
96		1		3		1	1		1	1	8	22.24
92			2	1			1	1			5	13.90
88					1		1				2	5.56
84					1	1	1				3	8.34
80	1	1		1	1						4	11.12
76	1										1	2.78
72										1	1	2.78
	2	5	4	7	4	3	6	1	1	3	36	100.08

	Score	Time
Median	96%	8 Minutes
Q1	84%	7 "
Q3	100%	12 "
Mean	92.33%	9.50 Minutes

Pupils up to accuracy and time standards 7 or 19.46%

Table XLI Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J. H, R, on A. P. Re-tests given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 4	5	6	7	8	9	10	11	12	13	14 to 26	Totals	Percentage at each point
100		8	9	9	3	3	3	4	3	2	2	46	25.76
96		2	3	5	4	3	4	1	2	3	6	33	18.48
92	1	3	3	9	2	1	4	3	6	2	3	37	20.72
88			2	4	1	4	4	1	2	1	7	26	14.56
84		1	1	2		3	1	2	1	1	3	15	8.40
80		1	1	1	1	3					2	9	5.04
76		2					2		1	1		6	3.36
72	1			1							2	4	2.24
68						1					1	2	1.12
64							1					1	.56
60												0	
56											1	1	.56
	2	17	19	31	11	18	19	11	15	10	27	180	100.80

	Score	Time
Median	92%	9 Minutes
Q1	88%	7 "
Q3	100%	12 "

Mean 91.33% 9.82 Minutes

Pupils up to accuracy and time standards 29 or 16.24%

Table XLII Showing distribution of Scores and Time made by pupils of Room L on S. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES									
in %	5	6	7	8	9	10	11	12	Totals	Percentage at each point
100	1	5	4	1	3				14	39.90
96		3	2		1		1		7	19.95
92	1		2			1			4	11.40
88			3			1			4	11.40
84						2		1	3	8.55
80				2					2	5.70
48						1			1	2.85
	2	8	11	3	4	5	1	1	35	99.75

	Score	Time
Median	96%	7 Minutes
Q1	88%	6 "
Q3	100%	8 "
Mean	92.91%	7.65 Minutes

Pupils up to accuracy and time standards 11 or 31.35%

Table XLIII Showing distribution of Scores and Time made by pupils of Room W on S. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	3	4	5	6	7	8	9	10	11	12 to 15	Totals	Percentage at each point
100		2	4	1	1	1					9	24.30
96		1	1	2			1				5	13.50
92	1		5	1	1					2	10	27.00
88		1	1		1						3	8.10
84			2								2	5.40
80		1		1					1	1	4	10.80
76								1		1	2	5.40
72						1				1	2	5.40
	1	5	13	5	3	2	1	1	1	5	37	99.90

	Score	Time
Median	92%	5 Minutes
Q1	84%	5 "
Q3	96%	8 "
Mean	90.48%	6.78 Minutes

Pupils up to accuracy and time standards 9 or 24.30%

Table XLIII Showing distribution of Scores and Time made by pupils of Room W on S. F. Re-test given in March. Scores are shown in top cells at the left, and time in minutes is shown at the top.

Scores	Time in minutes											
	2	3	4	5	6	7	8	9	10	11	12 to 15	Totals	Percentage at each point
100		2	4	1	1	1						9	24.30
95		1	1	2			1					6	15.50
90	1		5	1	1						2	10	27.00
85		1	1		1							3	8.10
80			2									2	5.40
75		1		1					1		1	4	10.30
70								1			1	2	5.40
65						1					1	2	5.40
	1	5	12	5	3	2	1	1	1	1	5	37	99.30

	Score	Time
Median	79%	5 Minutes
Q1	84%	5 "
Q3	90%	8 "

Item 70.45% 6.78 Minutes

Pupils up to accuracy and time standards 9 or 24.30%

Table XLIV Showing distribution of Scores and Time made by pupils of Room J on S. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 3	4	5	6	7	8	9	11	17	Totals	Percentage at each point
100		3	6	6	4	1	1	1		22	59.40
96	1	2		1			1			5	13.50
92			1	1	1		1			4	10.80
88					1		1		1	3	8.10
84											
80			1							1	2.70
76		1						1		2	5.40
	1	6	8	8	6	1	4	2	1	37	99.90

	Score	Time
Median	100%	6 Minutes
Q1	92%	5 "
Q3	100%	7 "

Mean 95.78% 6.48 Minutes

Pupils up to accuracy and time standards 20 or 54.00%

Table XLV Showing distribution of Scores and Time made by pupils of Room H on S. P. Re-test given in March Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES									
in %	4	5	6	7	8	9	10	11	Totals	Percentage at each point
100		3	2	4			1		10	33.30
96	1	1	3	1		1	1	2	10	33.30
92					1				1	3.33
88				2	1				3	9.99
84										
80	1			1					2	6.66
76										
72				1					1	3.33
68										
64						1			1	3.33
36						1			1	3.33
8		1							1	3.33
	2	5	5	9	2	3	2	2	30	99.90

	Score	Time
Median	96%	7 Minutes
Q1	88%	5 "
Q3	100%	8 "

Pupils up to accuracy and time standards 9 or 29.97%

Table XLVI Showing distribution of Score and Time made by pupils of Room R on S. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	2	3	4	5	6	7	8	9	10	11 to 14	Totals	Percentage at each point
100		1	3	2	1	1	2				10	29.40
96			4	1						2	7	20.58
92	1		1		1		1	1		1	6	17.64
88				1		1	1			1	4	11.76
84						1		1			2	5.88
80								1			1	2.94
76			1								1	2.94
72												
68			1						1		2	5.88
64												
60												
56				1							1	2.94
	1	1	10	5	2	3	4	3	1	4	34	99.96

	Score	Time
Median	92%	5 Minutes
Q1	88%	4 "
Q3	96%	8 "
Mean	90.94%	6.47 Minutes

Pupils up to accuracy and time standards 10 or 29.40%

Table XLVI Showing distribution of Score and Time made by pupils of Room E on S. E. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES													Totals	Percentage at each point
	1	2	3	4	5	6	7	8	9	10	11 to 14				
100		1	3	2	1		2							10	29.40
96			4	1							2			7	20.58
92		1		1		1		1	1		1			6	17.64
88					1		1	1			1			4	11.76
84							1		1					2	5.88
80									1					1	2.94
76				1										1	2.94
72															
68				1						1				2	5.88
64															
60															
56					1									1	2.94
	1	1	10	6	2	3	4	3	1	1	4			34	99.96

	Score	Time
Median	92%	5 Minutes
Q1	88%	4 "
Q3	96%	6 "
Mean	90.94%	6.47 Minutes

Pupils up to accuracy and time standards 10 or 29.40%

Table XLVII Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J, H, R, on S. P. Re-tests given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	2	3	4	5	6	7	8	9	10	11 to 17	Totals	Percentage at each point
100		1	8	16	15	14	5	4	1	1	65	37.70
96		1	8	3	9	3		4	1	5	34	19.72
92	1	1	1	7	3	4	2	2	1	3	25	14.50
88			1	2		8	2	1	1	2	17	9.86
84				2		1		1	2	1	7	4.06
80			2	1	1	1	2	1		2	10	5.80
76			2						1	2	5	2.90
72						1	1			1	3	1.74
68			1						1		2	1.16
64								1			1	.58
60												
56				1							1	.58
48									1		1	.58
36								1			1	.58
8				1							1	.58
	1	3	23	33	28	32	12	15	9	17	173	100.34

	Score	Time
Median	96%	6 Minutes
Q1	88%	5 "
Q3	100%	9 "
Mean	93.19%	6.87 Minutes

Pupils up to accuracy and time standards 59 or 34.22%

Table XIVII Summary Table - Showing distribution of Scores and Time made by pupils of Scores 1, 2, 3, 4, 5, on S. E. Jo-Davis River in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

| Scores | Time in Minutes | | |

Table XLVIII Showing distribution of Score and Time made by pupils in Room L on M. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES												
in %	6	7	8	9	10	11	12	13	14	15	16 to 27	Total	Percentage at each point
100					1							1	2.78
96					1							1	2.78
92				1	1				1			3	8.34
88				2	1				1		1	5	13.90
84	1			1					1		2	5	13.90
80						1	2		1		1	5	13.90
76				2	1			1			2	6	16.68
72		1						1		1	1	4	11.12
68							3					3	8.34
60					1							1	2.78
48									1			1	2.78
40											1	1	2.78
	1	1		6	6	1	5	2	5	1	8	36	100.08

	Score	Time
Median	76%	12 Minutes
Q1	72%	10 "
Q3	88%	14 "
Mean	78.56%	12.80 Minutes

Pupils up to accuracy and time standards 1 or 2.78%

Table XLIX Showing distribution of Score and Time made by pupils of Room W on M. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	6	7	9	10	11	12	14	15	16	17 to 21	Totals	Percentage at each point
100					1						1	2.70
96												
92			1							1	2	5.40
88		1	1	2						1	5	13.50
84			1	3		1					5	13.50
80				2				1			3	8.10
76				1			1			1	3	8.10
72		1	1	1	2						5	13.50
68				1		1		2			4	10.80
64	1		1							2	4	10.80
60									1		1	2.70
56				2							2	5.40
36										1	1	2.70
	1	2	5	12	3	2	1	3	1	7	37	99.20

	Score	Time
Median	76%	10 Minutes
Q1	64%	10 "
Q3	84%	15 "
Mean	74.05%	12.13 Minutes

Pupils up to accuracy and time standards 1 or 2.70%

Table XIIX Showing distribution of Scores and Time made by pupils of Room W on M. T. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

| SCORES | TIME IN MINUTES | | |

Table L Showing distribution of Scores and Time made by pupils of Room J on M. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	6	7	8	9	10	11	12	13	14	15 to 18	Totals	Percentage at each point
100		2			1	1	1	1			6	15.78
96				1	1	2					4	10.52
92	1	1	1		2					2	7	18.41
88		1			2	1	1				5	13.15
84			1		1	1	2				5	13.15
80							1	1	1	1	4	10.52
76				1			1		1		3	7.89
72								1			1	2.63
64			1								1	2.63
60			1							1	2	5.26
	1	4	4	2	7	5	6	3	2	4	38	99.94

	Score	Time
Median	88%	11 Minutes
Q1	80%	9 "
Q3	96%	12 "
Mean	86.63%	10.92 Minutes

Pupils up to accuracy and time standards 5 or 13.15%

Table I. Showing distribution of Scores and Time made by pupils of Room J on M. F. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES												
in %	6	7	8	9	10	11	12	13	14	15 to 18	Totals	Percentage at each point
100		2			1	1	1	1			6	15.78
96				1	1	2					4	10.52
92	1	1	1		2					2	7	18.41
88		1			2	1	1				5	13.15
84			1		1	1	2				5	13.15
80							1	1	1	1	4	10.52
76				1			1		1		3	7.89
72								1			1	2.63
64			1								1	2.53
60			1							1	2	5.26
	1	4	4	2	7	5	6	3	2	4	38	99.94

	Score	Time
Median	88%	11 Minutes
Q1	80%	9 "
Q3	96%	12 "
Mean	86.83%	10.92 Minutes

Pupils up to accuracy and time standards 5 or 13.15%

Table LI Showing distribution of Scores and Time made by pupils in Room H on M. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	6	7	9	10	11	12	14	15	16	18	Total	Percentage at each point
100						1					1	3.13
96	1	1									2	6.26
92	1		2	2							5	15.56
88				1	1	2		1	1		6	18.78
84		1			1	1		1			4	12.52
80		1		2			2				5	15.65
76							1			1	2	6.26
72		1	1	1							3	9.39
68		1					1				2	6.26
60		1									1	3.13
12								1			1	3.13
	2	6	3	6	2	4	4	3	1	1	32	100.16

	Score	Time
Median	84%	10 Minutes
Q1	76%	7 "
Q3	88%	14 "
Mean	81.00%	11.06 Minutes

Pupils up to accuracy and time standards 1 or 3.13%

Table LII Showing distribution of Score and Time made by pupils in Room R on M. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 5	6	7	8	9	10	11	12	14 & 15	Total	Percentage at each point
100	1		1					1		3	9.09
96		1	2	1	3			4		11	33.33
92				2		1	1	1		5	15.15
88	1		1			2				4	12.12
84					1					1	3.03
80				1	1	2		1		5	15.15
76						1				1	3.03
64					1					1	3.03
56									1	1	3.03
52									1	1	3.03
	2	1	4	4	6	6	1	7	2	33	99.99

	Score	Time
Median	92%	9 Minutes
Q1	88%	8 "
Q3	96%	12 "

Mean 87.88% 9.51 Minutes

Pupils up to accuracy and time standards 3 or 9.09

Table LIII Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J, H, R, on M. P. Re-test given in March. Scores are shown in per cents at left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	5 & 6	7	8	9	10	11	12	13	14	15 to 27	Totals	Percentage at each point
100	1	3			2	2	3	1			12	6.84
96	2	3	1	4	2	2	4				18	10.26
92	2	1	3	4	6	1	1		1	3	22	12.54
88	1	3		3	8	2	3		1	4	25	14.25
84	1	1	1	3	4	2	4		1	3	20	11.40
80		1	1	1	6	1	4	1	4	3	22	12.54
76			3	3			1	1	3	4	15	7.67
72		3		2	2	2		2		2	13	7.41
68		1			1		4		1	2	9	5.13
64	1		1	2						2	6	3.42
60		1	1		1					2	5	2.85
56					2				1		3	1.71
52										1	1	.57
48									1		1	.57
40										1	1	.57
36										1	1	.57
32										1	1	.57
12										1	1	.57
	8	17	8	22	37	12	24	5	13	30	176	99.94

	Score	Time
Median	84%	10 Minutes
Q1	76%	9 "
Q3	92%	13 "
Mean	81.55%	11.27 Minutes

Pupils up to accuracy and time standards 11 or 6.27%

could be excused from further drill in multiplication. The range in score was from 100% to 12% and the range in time was from 5 to 27 minutes. The median score was 84% and the median time was 10 minutes. The mean score was 81.55% and the mean time was 11.27 minutes. Thus 169 pupils or 93.73% still need corrective work in multiplication.

The summary table for long division is table LIX. This table shows that out of 179 pupils taking the test 35 or 19.43% obtained a perfect score. However, of these 35 pupils only 31 or 17.36% were up to both accuracy and time standards and so could be excused from further drill in long division. The range in score was from 100% to 0% and the range in time was from 8 to 55 minutes. The median score was 88% and the median time was 19. minutes. The mean score was 85.03% and the mean time was 22.77 minutes. Thus 148 pupils or 82.64% still need corrective work in long division.

5. CORRECTIVE LOAD IN MARCH.

As a result of this study the corrective load has decreased in each process. In addition 151 pupils or 83.76% make up the corrective load in March. In subtraction 114 pupils or 65.78% make up the corrective load in March. In multiplication 169 pupils or 93.73% make up the corrective load in March. In long division 148 pupils or 82.64% make up the corrective load in March.

could be excused from further drill in multiplication. The range in score was from 100% to 19% and the range in time was from 5 to 27 minutes. The median score was 84% and the median time was 10 minutes. The mean score was 81.55% and the mean time was 11.27 minutes. Thus 109 pupils or 93.79% still need corrective work in multiplication.

The summary table for long division is table XIX. This table shows that out of 179 pupils taking the test 35 or 19.55% obtained a perfect score. However, of these 35 pupils only 31 were up to both accuracy and time standards and so could be excused from further drill in long division. The range in score was from 100% to 0% and the range in time was from 8 to 52 minutes. The median score was 88% and the median time was 19. minutes. The mean score was 55.05% and the mean time was 22.77 minutes. Thus 148 pupils or 82.68% still need corrective work in long division.

5. CORRECTIVE LOAD IN MARCH.

As a result of this study the corrective load has decreased in each process. In addition 151 pupils or 85.75% make up the corrective load in March. In subtraction 114 pupils or 65.75% make up the corrective load in March. In multiplication 109 pupils or 93.79% make up the corrective load in March. In long division 148 pupils or 82.68% make up the corrective load in March.

Table LIV Showing distribution of Scores and Time made by pupils of Room L on L. D. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	14 & 15	16	17	18	19	20	21 to 24	25 to 29	31 to 36	44 & 48	Totals	Percentage at each point
100					1	1	1				3	8.10
96		1		1	3						5	13.50
92		1		2	1		2				6	16.20
88	1					2	2		1		6	16.20
84	2		1		1		1	1	1		7	18.90
80	1		1								2	5.40
72								1			1	2.70
68								1			1	2.70
64									1		1	2.70
60							1				1	2.70
56										1	1	2.70
24									1		1	2.70
16								1			1	2.70
12										1	1	2.70
	4	2	2	3	6	3	7	4	4	2	37	99.90

	Score	Time
Median	88%	20 Minutes
Q1	80%	18 "
Q3	92%	28 "
Mean	80.38%	22.64 Minutes

Pupils up to accuracy and time standards 2 or 5.40%

Table LV Showing distribution of Scores and Time made by pupils of Room W on L. D. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	10	11	14	15	17	18	20	21 to 26	30 to 35	50 to 55	Total	Percentage at each point
100		1		2		1					4	11.40
96					1		1	1			3	8.55
92						2		3			5	14.25
88				2			1		1		4	11.40
84			1	1		1		2	1	1	7	19.95
80									1	1	2	5.70
72									1		1	2.85
68	1								2		3	8.55
64								1	1		2	5.70
44									1		1	2.85
36								1			1	2.85
24									1		1	2.85
0				1							1	2.85
	1	1	1	6	1	4	2	8	9	2	35	99.75

	Score	Time
Median	84%	21 Minutes
Q1	68%	15 "
Q3	92%	30 "
Mean	78.46%	23.82 Minutes

Pupils up to accuracy and time standards 4 or 11.40%

Table LVII Showing distribution of Scores and Time made by pupils of Room J on L. D. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	8	10	11	12	13	17	18	20	21 to 25	30 & 35	Total	Percentage at each point
100	1			1	5	2		1	3		13	35.10
96			1		2						3	8.10
92	1					1	1	2	2		7	18.90
88		1						1	4	1	7	18.90
84					1						1	2.70
76									2	1	3	8.10
72										1	1	2.70
64										1	1	2.70
60								1			1	2.70
	2	1	1	1	8	3	1	5	11	4	37	99.90

	Score	Time
Median	92%	20 Minutes
Q1	88%	13 "
Q3	100%	23 "
Mean	90.73%	16.24 Minutes

Pupils up to accuracy and time standards 10 or 27.00%

Table XVI. Showing distribution of Scores and Time made by pupils of Room 1 on I. E. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES																	
In %	8	10	11	12	13	14	16	18	20	25	30 to 35	35	Total	Percentage at each point
100				1	5		2		1	3			12	35.10
96			1		2								3	8.10
92	1						1	1	2				5	16.90
88		1							1	4	1		7	18.90
84					1								1	2.70
76										2	1		3	8.10
72											1		1	2.70
64											1		1	2.70
60									1				1	2.70
	2	1	1	1	8		3	1	5	11	4		37	99.90

	Score	Time
Median	88%	20 Minutes
Q1	88%	15 "
Q3	100%	25 "
Mean	90.72%	16.24 Minutes

Pupils up to accuracy and time standards 10 or 27.00%

Table LVII Showing distribution of Scores and Time made by pupils of Room H on L. D. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES										
in %	9	10	12	13	14	15	17 to 19	20 to 27	30 to 40	Totals	Percentage at each point
100	1	1			2	2	2			8	22.80
96		1	1	2			2	3	1	10	28.50
92						1	1	1		3	8.55
88								5	1	6	17.10
84				1				1		2	5.70
80											
76						1			1	2	5.70
72								1		1	2.85
68							1			1	2.85
28									1	1	2.85
16							1			1	2.85
	1	2	1	3	2	4	7	11	4	35	99.75

	Score	Time
Median	96%	17 Minutes
Q1	98%	14 "
Q3	96%	26 "
Mean	87.66%	20.25 Minutes

Pupils up to accuracy and time standards 8 or 22.80%

Table LVIII Showing distribution of Scores and Time made by pupils of Room R on L. D. P. Re-test given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES											
in %	8	9	10	11	14	15	16	17	18	19 to 41	Total	Percentage at each point
100	1		3				1		2		7	19.95
96		1			1	1	2			1	6	17.10
92				1			1		1	1	4	11.40
88						1	1	1	1	4	8	22.80
84					1			1		2	4	11.40
80								1			1	2.85
76						1				1	2	5.70
56										1	1	2.85
52									1		1	2.85
36										1	1	2.85
	1	1	3	1	2	3	5	3	5	11	35	99.75

	Score	Time
Median	88%	17 Minutes
Q1	84%	15 "
Q3	96%	20 "
Mean	87.78%	17.57 Minutes

Pupils up to accuracy and time standards 7 or 19.95%

Table LIX Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J, H, R on L. D. P. Re-tests given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES in %	TIME IN MINUTES 8 & 9	10 & 11	12 & 13	14 & 15	16 & 17	18 & 19	20	21 to 29	30 to 40	41 to 55	Total	Percentage at each point
100	3	5	6	6	5	4	2	4			35	19.43
96	1	2	5	2	5	5	1	5	1		27	15.12
92	1	1		1	3	8	3	8			25	14.00
88		1		4	2	1	7	12	4		31	17.36
84			2	5	2	3	1	5	2	1	21	11.76
80				1	2				1	1	5	2.80
76				2				3	2		7	3.92
72								2	2		4	2.24
68		1				1		1	2		5	2.80
64								1	3		4	2.24
60						1				1	2	1.12
56						1				1	2	1.12
52						1					1	.56
44									1		1	.56
36								2			2	1.12
28									1		1	.56
24									2		2	1.12
16						1		1			2	1.12
12										1	1	.56
0				1							1	.56
	5	10	13	22	19	26	14	44	21	5	179	100.04

	Score	Time
Median	88%	19 Minutes
Q1	84%	15 "
Q3	92%	25 "
Mean	85.03%	22.77 Minutes

Pupils up to accuracy and time standards 31 or 17.36%

Table LIX Summary Table - Showing distribution of Scores and Time made by pupils of Rooms L, W, J, H, R on L. D. P. Re-tests given in March. Scores are shown in per cents at the left, and time in minutes is shown at the top.

SCORES	TIME IN MINUTES												
in %	8 & 9	10 & 11	12 & 13	14 & 15	16 & 17	18 & 19	20	21 to 29	30 to 40	41 to 55	Total	Percentage at each point
100	3	5	6	6	5	4	2	4			35	19.43
96	1	2	5	2	5	5	1	5	1		27	15.12
92	1	1		1	3	8	3	8			25	14.00
88		1		4	2	1	7	12	4		31	17.36
84			2	5	2	3	1	5	2	1	21	11.76
80				1	2				1	1	5	2.80
76				2				3	2		7	3.92
72								2	2		4	2.24
68		1				1		1	2		5	2.80
64								1	3		4	2.24
60						1				1	2	1.12
56						1				1	2	1.12
52						1					1	.56
44									1		1	.56
36								2			2	1.12
28									1		1	.56
24									2		2	1.12
16						1		1			2	1.12
12										1	1	.56
0				1							1	.56
	5	10	15	22	19	26	14	44	21	5	179	100.04

	Score	Time
Median	88%	19 Minutes
Q1	84%	15 "
Q3	92%	25 "
Mean	85.03%	22.77 Minutes

Pupils up to accuracy and time standards 31 or 17.36%

CHAPTER VI. COMPARISON OF RESULTS OF THE INITIAL AND THE RE-TEST.

1. COMPARISON OF THE PERFECT SCORES OBTAINED IN INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.
2. COMPARISON IN THE NUMBER OF PUPILS HAVING 100% SCORES IN ONE OR MORE PROCESSES BY ROOMS IN INITIAL AND RE-TEST.
3. IMPROVEMENT IN MEAN SCORES IN ALL ROOMS IN EACH PROCESS.
4. DECREASE IN MEAN TIME IN ALL ROOMS IN EACH PROCESS.
5. IMPROVEMENT IN MEAN SCORES IN DECREASE OF MEAN TIME BETWEEN INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.
6. RESULTS OF THE EXPERIMENTAL GROUP, ROOM R, ON INITIAL AND RE-TEST IN EACH PROCESS.
7. COMPARISON OF SPREAD OF SCORES ON INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.
8. COMPARISON OF THE CORRECTIVE LOAD OF THE BEGINNING AND AT THE END OF THIS STUDY.
9. STATISTICAL SIGNIFICANCE OF DATA.

CHAPTER VI. COMPARISON OF RESULTS OF THE INITIAL TEST AND THE RE-TEST.

Since the benefit of all testing lies in the story which is revealed by the test, in this chapter an attempt will be made to compare the results of the Initial Test and the Re-test to show what has been accomplished as a result of the corrective program carried on for five months in this district.

1. COMPARISON OF PERFECT SCORES OBTAINED IN INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.

As the standard adhered to throughout this study has been the 100% perfect score, it will be interesting to compare the number of perfect scores obtained on both tests. This was done by rooms for each process. Table LX. shows that in the Initial A. P. Test there were 20 with a perfect score, while in the Re-test there were 46 which is a gain of 26. The time standard is ignored in this table. In the Initial S. P. Test there were 20 perfect scores, while on the Re-test there were 65 which is a gain of 45. In the Initial M. P. Test there were 0 perfect scores, while on the Re-test there were 12, making a gain of 12. In the Initial L. D. P. Test there were 6 perfect scores, while in the Re-test there were 35, making a gain of 29. The total number of perfect scores on the Initial Test was 46, while on the Re-test the total number was 158, making a total gain of 112 perfect scores. (The totals for each room may also be seen from Table LXII.)

The gains in the number of perfect scores are expressed in percent at the bottom of Table LX. for each process. In Addition the gain was 14.73%, in Subtraction 26.59%, in Multiplication 6.82% and in Long Division 14.15%. Thus a gain was made in each process.

Table LX. Showing Comparison of Perfect Scores obtained on Initial and Re-test by Rooms for each process. Total gains expressed in percent for each process are shown in lower half of table.

	A. P.		S. P.		M. P.		L. D. P.		Totals.		
Rm.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Gain By Rooms.
L.	1	8	3	14	0	1	0	3	4	26	22 or 15.27%
W.	4	6	5	9	0	1	0	4	9	20	11 or 7.43%
J.	3	14	3	22	0	6	3	13	9	55	46 or 30.89%
H.	7	6	3	10	0	1	1	8	11	25	14 or 11.02%
R.	5	12	6	10	0	3	2	7	13	32	19 or 14.59%
Tl.	20	46	20	65	0	12	6	35	46	158	112
Gains For Each Process.	26		45		12		29		112		

Gains in number of perfect scores for entire group expressed in percent.

A. P.	S. P.	M. P.	L. D. P.
Oct. $\frac{20}{185}$ -10.82%	Oct. $\frac{20}{182}$ -10.98%	Oct. $\frac{0}{187}$ - 0%	Oct. $\frac{6}{187}$ - 3.21%
Mar. $\frac{46}{180}$ -25.55%	Mar. $\frac{65}{173}$ -34.57%	Mar. $\frac{12}{176}$ - 6.82%	Mar. $\frac{35}{179}$ -17.36%
Gain. 14.73%	Gain. 26.59%	Gain. 6.82%	Gain. 14.15%

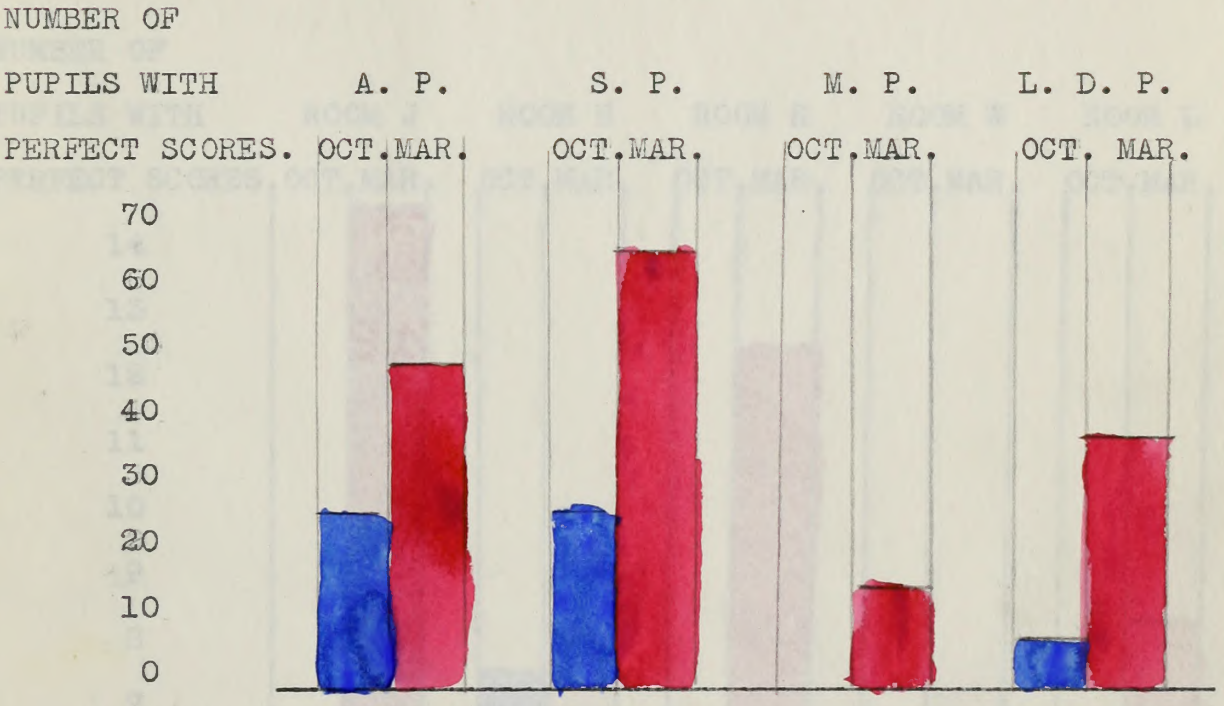
Table IX. Showing Comparison of Perfect Scores obtained on Initial and Re-test by Rooms for each process. Total gains expressed in percent for each process are shown in lower half of table.

Rm.	A. P. Oct.	A. P. Mar.	S. P. Oct.	S. P. Mar.	M. P. Oct.	M. P. Mar.	L. D. P. Oct.	L. D. P. Mar.	Totals. Gain By Rooms.
L.	1	8	3	14	0	1	0	3	4 26 22 or 15.87%
W.	4	6	5	9	0	1	0	4	9 20 11 or 7.45%
J.	3	14	3	22	0	6	3	15	9 55 46 or 30.89%
H.	7	6	3	10	0	1	1	8	11 25 14 or 11.02%
R.	5	12	6	10	0	3	2	7	15 32 19 or 14.59%

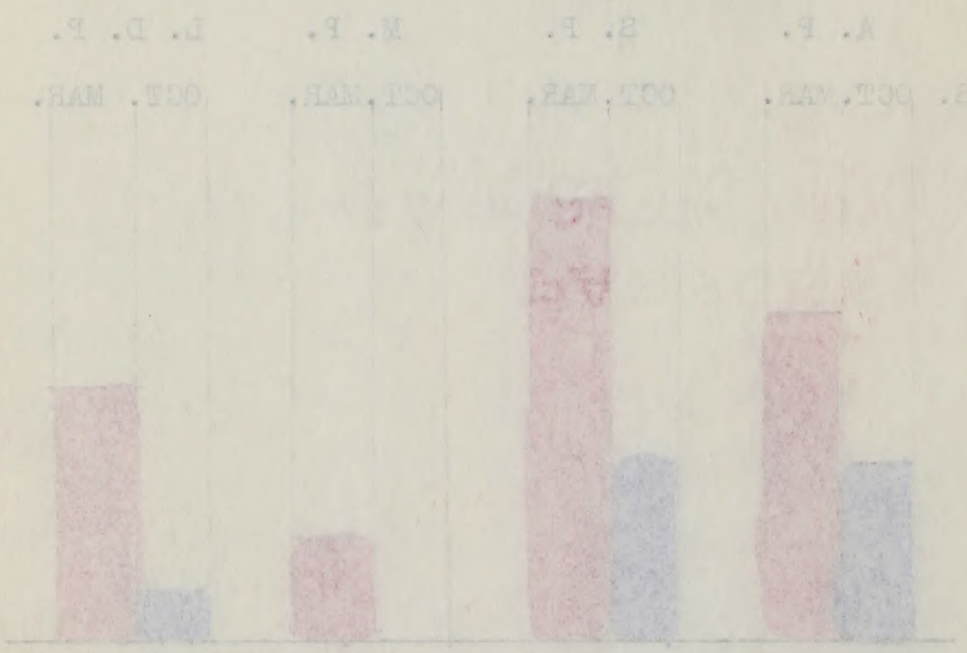
Tl.	20	46	20	66	0	12	6	35	46 158 112
Gains For Each Process.		26		46		12		29	112

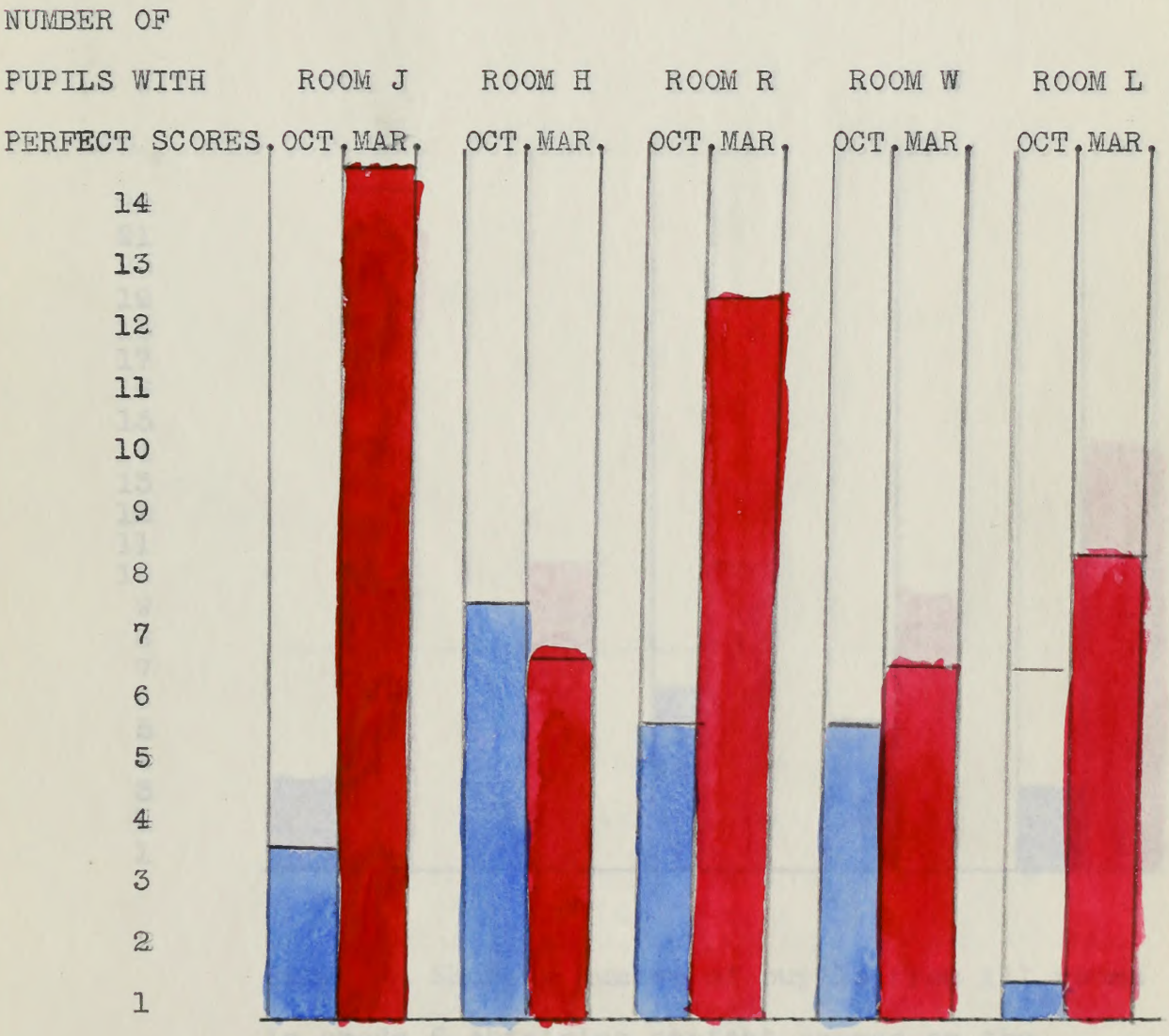
Gains in number of perfect scores for entire group expressed in percent.

	A. P.	S. P.	M. P.	L. D. P.
Oct.	$\frac{20}{185}$-10.85%	Oct. $\frac{20}{185}$-10.98%	Oct. $\frac{0}{187}$- 0%	Oct. $\frac{6}{187}$- 3.21%
Mar.	$\frac{46}{180}$-25.55%	Mar. $\frac{66}{179}$-36.87%	Mar. $\frac{12}{176}$- 6.82%	Mar. $\frac{35}{179}$-17.59%
Gain.	14.75%	Gain. 26.89%	Gain. 6.82%	Gain. 14.15%

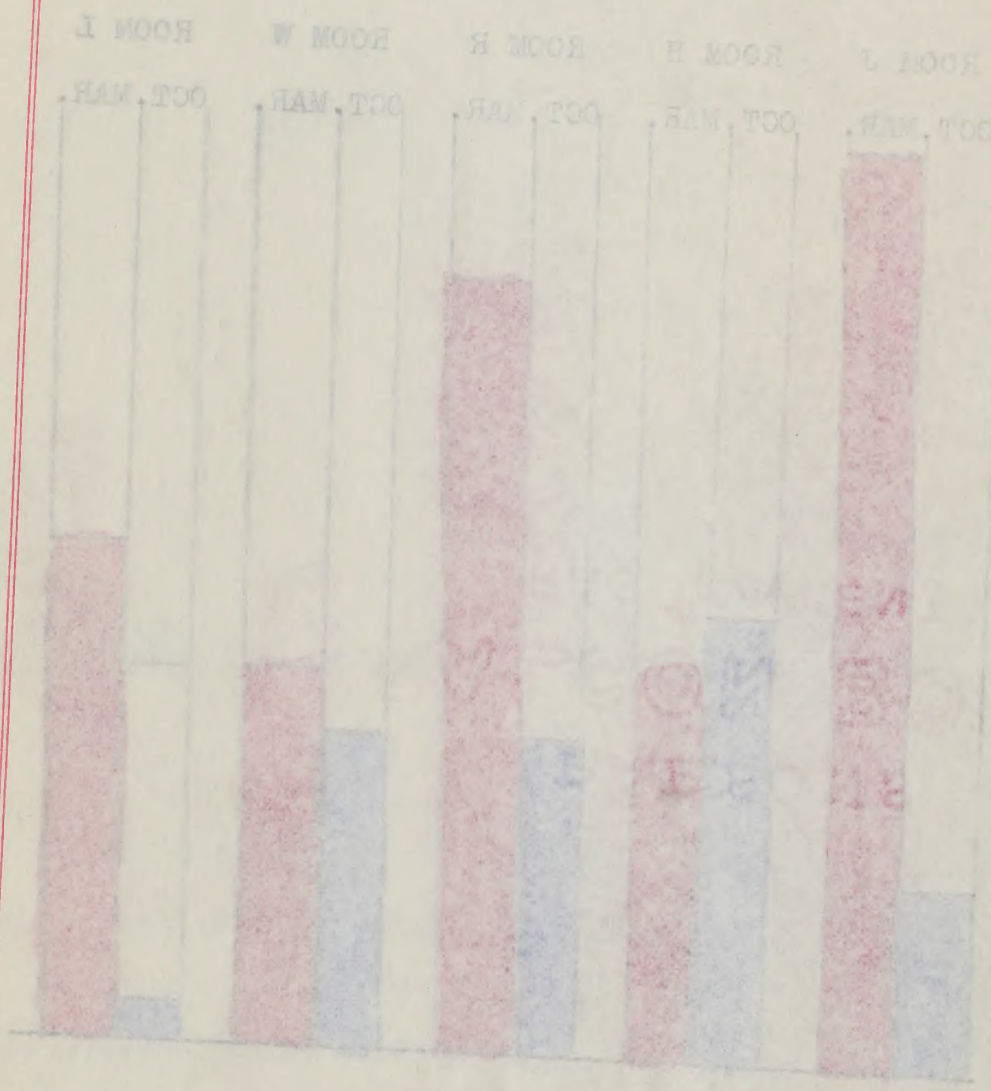


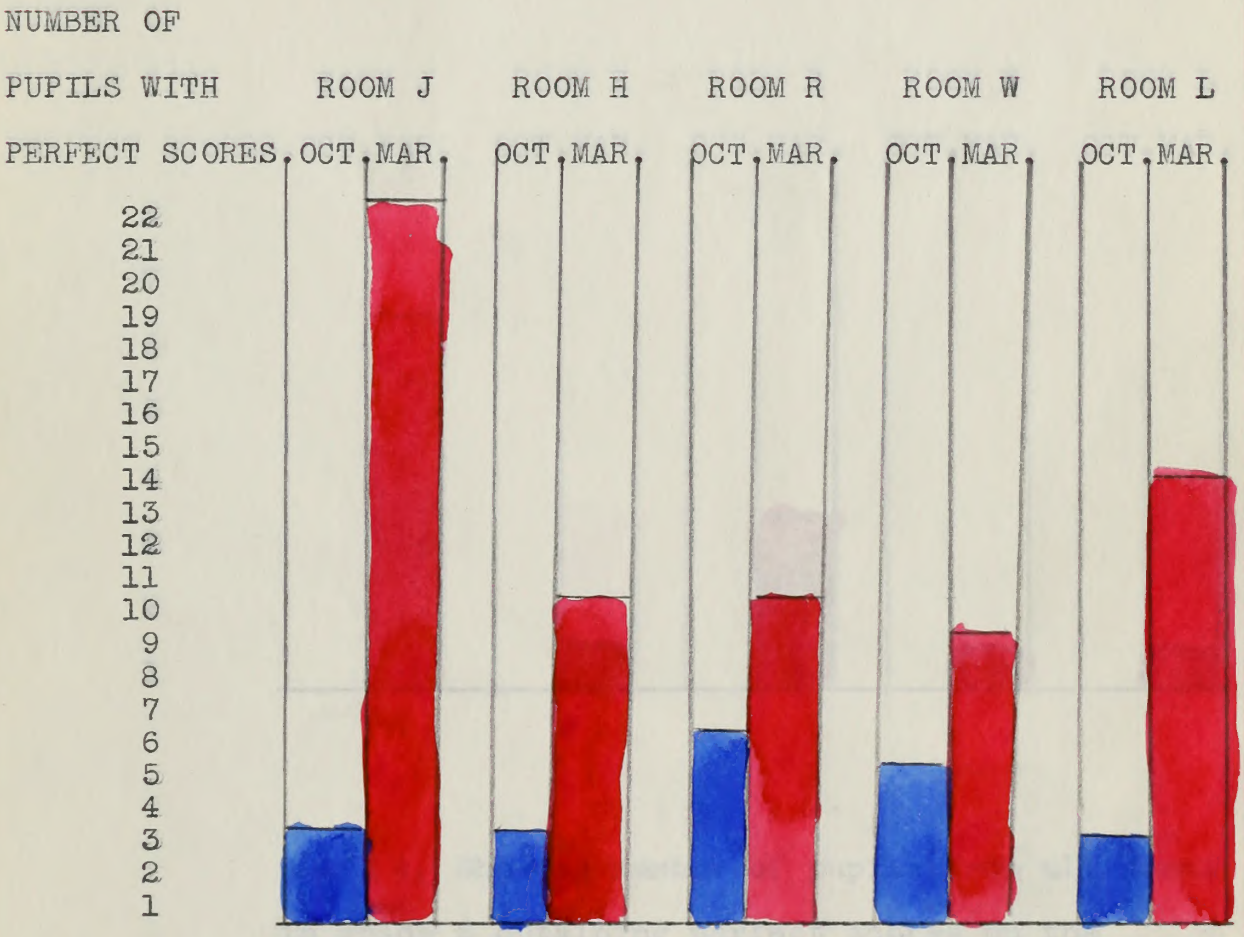
GRAPH 1. Showing number of pupils from all rooms in grade 6 obtaining perfect scores on the Initial Test in Oct. and on the Re-test in Mar. for each process. The Initial Test is shown in blue and the Re-test in red.


A. P.
OCT. MAR.
S. P.
OCT. MAR.
M. P.
OCT. MAR.
L. D. P.
OCT. MAR.



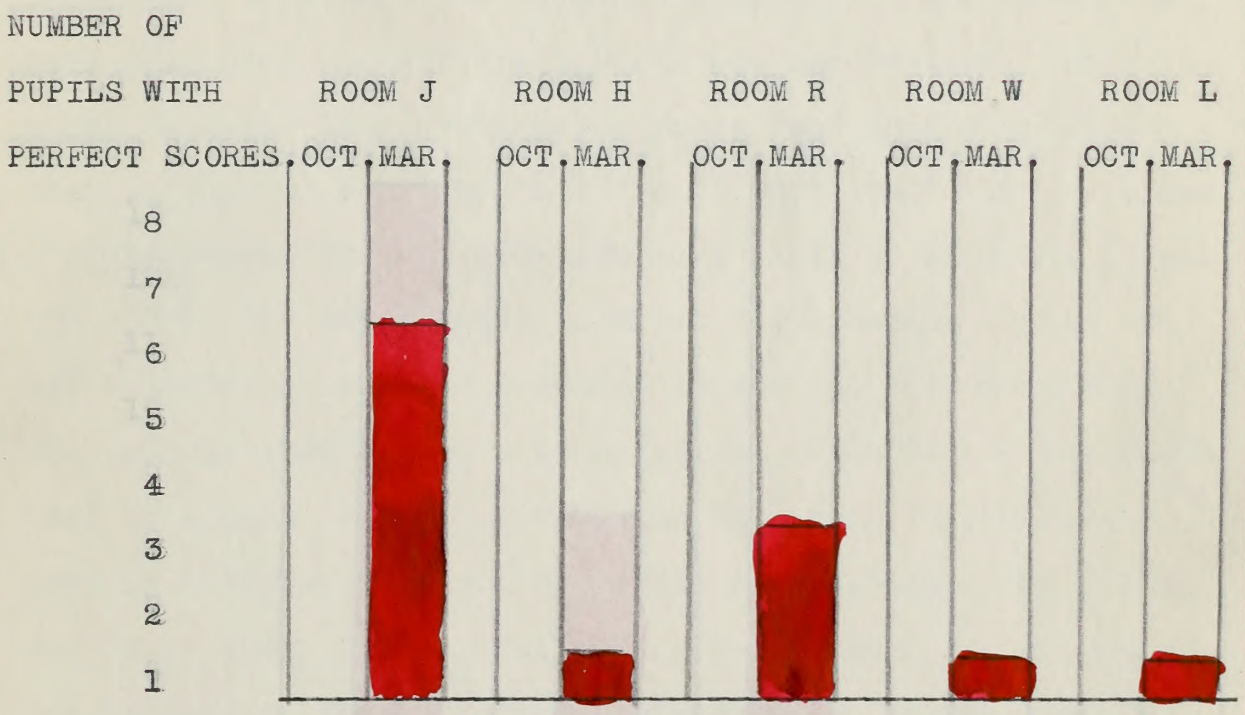
GRAPH 2. Showing number of pupils from all rooms in grade 6 obtaining perfect scores on the Initial Test in Oct. and on the Re-test in Mar. for ADDITION. The Initial Test is shown in blue and the Re-test in red.


ROOM L
OCT. MAR.
ROOM W
OCT. MAR.
ROOM R
OCT. MAR.
ROOM H
OCT. MAR.
ROOM J
OCT. MAR.

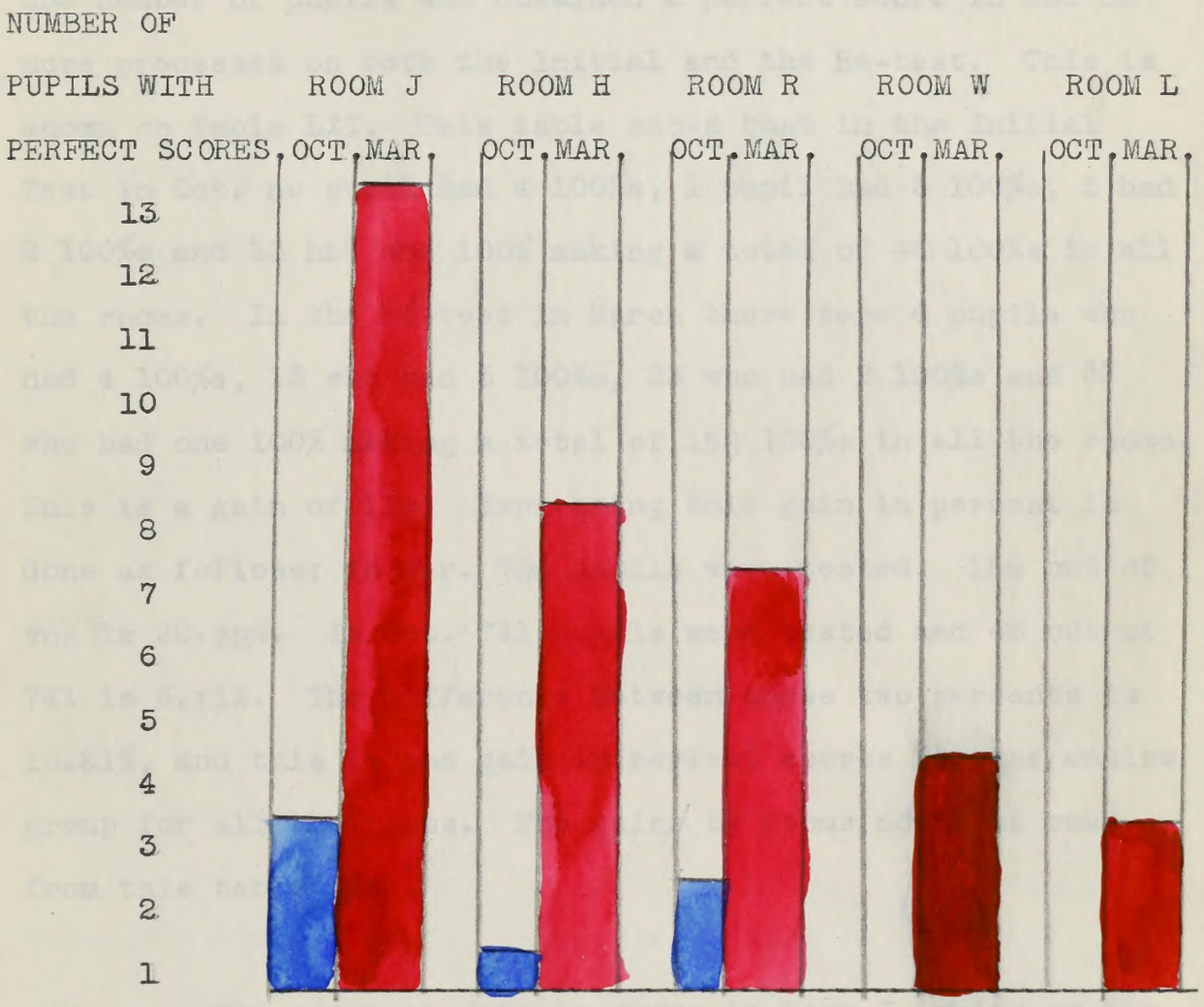


GRAPH 3. Showing number of pupils from all rooms in grade 6 obtaining perfect scores on the Initial Test in Oct. and on the Re-test in Mar. for SUBTRACTION. The Initial Test is shown in blue and the Re-test in red.

ROOM L
OCT. MAR.
ROOM M
OCT. MAR.
ROOM R
OCT. MAR.
ROOM H
OCT. MAR.
ROOM J
OCT. MAR.
NUMBER OF PUPILS WITH PERFECT SCORES
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

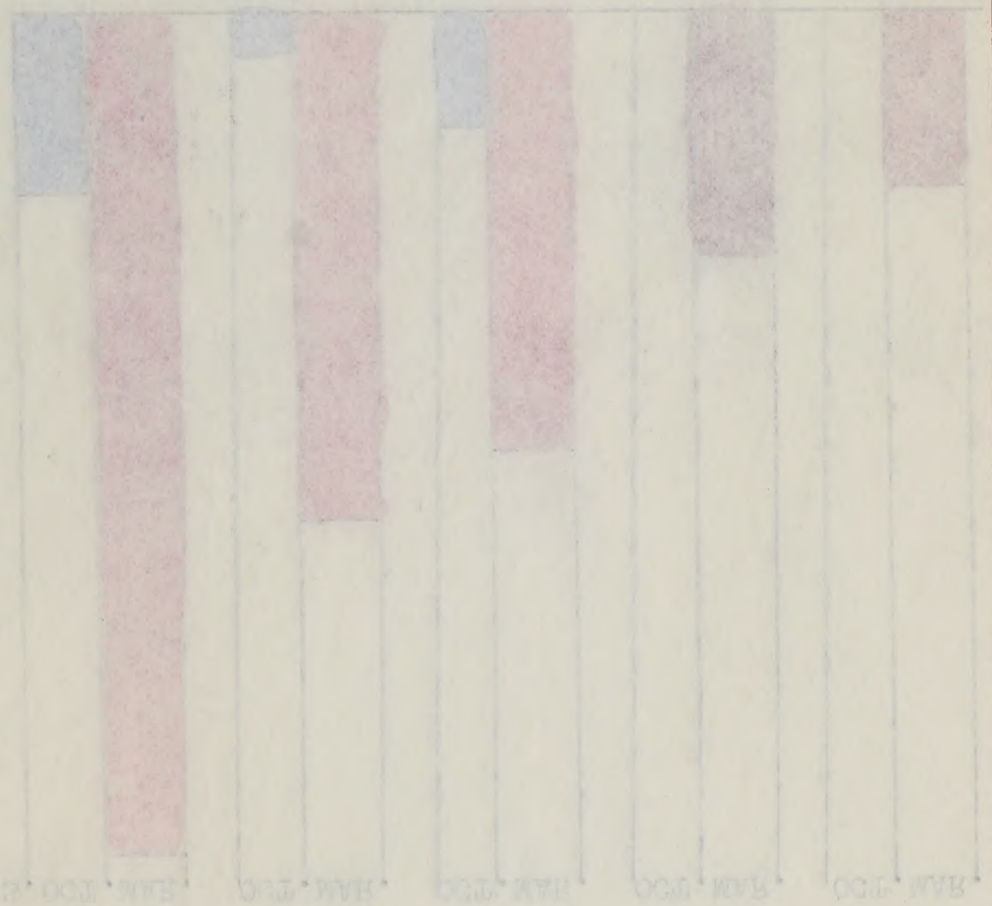


GRAPH 4. Showing number of pupils from all rooms in grade 6 obtaining perfect scores on the Initial Test in Oct. and on the Re-test in Mar. for MULTIPLICATION. The Initial Test is shown in blue and the Re-test in red.



Comparing the Total.

GRAPH 5. Showing number of pupils from all rooms in grade 6 obtaining perfect scores on the Initial Test in Oct. and on the Re-test in Mar. for LONG DIVISION. The Initial Test is shown in blue and the Re-test in red.



2. COMPARISON IN THE NUMBER OF PUPILS HAVING 100% SCORES IN ONE OR MORE PROCESSES BY ROOMS IN INITIAL AND RE-TEST.

Another way to show progress is to show the gain in the number of pupils who obtained a perfect score in one or more processes on both the Initial and the Re-test. This is shown on Table LXI. This table shows that in the Initial Test in Oct. no pupil had 4 100%s, 1 pupil had 3 100%s, 5 had 2 100%s and 33 had one 100% making a total of 46 100%s in all the rooms. In the Re-test in March there were 4 pupils who had 4 100%s, 13 who had 3 100%s, 23 who had 2 100%s and 57 who had one 100% making a total of 158 100%s in all the rooms. This is a gain of 112. Expressing this gain in percent is done as follows; in Mar. 708 pupils were tested. 158 out of 708 is 22.32%. In Oct. 741 pupils were tested and 46 out of 741 is 6.11%. The difference between these two percents is 16.21%, and this is the gain in perfect scores for the entire group for all the tests. The gains by rooms could be read from this table also.

The greatest gain is shown in Room J, which on the first test had 2 pupils with 2 100%s and 5 with one 100% making a total of 9 perfect scores. On the Re-test they had 3 pupils with 4 100%s, 5 with 3 100%s, 5 with 2 100%s and 18 with one 100% making a total of 55 perfect scores. This is a gain of 46 or 130.89%. The time standard is ignored in this table.

Table LXI. Showing a Comparison in the number of Pupils having 100% Scores in one or more processes by rooms on both the Initial and the Re-test, four perfect scores being possible.

	4-100%s		3-100%s		2-100%s		1-100%s		Total		
Rm.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Gain
L.	0	0	0	3	0	4	4	9	4	26	22
W.	0	0	0	1	2	2	5	13	9	20	11
J.	0	3	0	5	2	5	5	18	9	55	46
H.	0	0	0	1	0	7	11	8	11	25	14
R.	0	1	1	3	1	5	8	9	13	32	19
Totals	0	4	1	13	5	23	33	57	46	158	112
100%s Gained	16		36		36		25		112		

Gain in number of perfect scores expressed in percent.

Oct. $\frac{46}{741}$ - 6.11%

Mar. $\frac{158}{708}$ - 22.32%

Gain is difference between these percents. 16.21%

Table LXI. Showing a Comparison in the number of pupils having 100% Scores in one or more processes by rooms on both the Initial and the Re-test, four perfect scores being possible.

	4-100%s		3-100%s		2-100%s		1-100%s		Total		
Rm.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Gain
L.	0	0	0	3	0	4	4	9	4	26	22
W.	0	0	0	1	2	2	5	13	9	20	11
J.	0	3	0	3	2	5	6	18	8	36	28
A.	0	0	0	1	0	7	11	8	11	25	14
R.	0	1	1	3	1	8	8	9	13	32	19
Totals											
	0	4	1	13	5	26	34	57	46	138	112
100%s Gained		16		36		26		112			

Gain in number of perfect scores expressed in percent.

$$\text{Oct. } \frac{46}{\text{VII}} - 6.11\%$$

$$\text{Mar. } \frac{138}{208} - 28.32\%$$

Gain is difference between these percents. 16.21%

3. IMPROVEMENT IN MEAN SCORES IN ALL ROOMS IN EACH PROCESS.

Still another way to show that an improvement has taken place in the work of these groups is done by comparing the mean scores for each process test. This is done in Table LXII by rooms. In Room L on the Initial A. P. TEST the mean score was 71.64% and on the Re-test it was 91.24%. This is an improvement of 19.60%. In the S. P. TEST in Oct., Room L had a mean score of 73.36% and on the Re-test in Mar., it had 92.91%. This is an increase of 19.55%. On the Initial M. P. TEST, Room L had a mean score of 46.15% and on the Re-test, it had 78.56%. This is an increase of 32.41%. In the L. D. P. TEST in Oct., Room L had a mean score of 50.61% and on the Re-test in Mar., it had 80.38%. This is an increase of 29.77%. The results for the other rooms may be read in the same manner.

The comparison of the mean scores for the entire group shows gains as follows:

A. P. Initial	82.59%	Re-test	91.33%	Gain	8.74%
S. P.	83.56%		83.19%	Loss	.37%
M. P.	57.71%		81.55%	Gain	23.84%
L. D. P.	66.46%		85.03%	Gain	18.57%

The loss in subtraction is probably accounted for by the large absence due to illness which prevailed on the day of the Re-test in some rooms. The subtraction process showed the largest gain in perfect scores. The greatest gain in mean

score was in multiplication; long division was a close second.

Table LXII. Showing the Improvement in Mean Scores, expressed in percent, for all Rooms in each process from the Initial to the Re-test.

	A. P.		S. P.		M. P.		L. D. P.	
Room L.	Oct. %	Mar. %	Oct. %	Mar. %	Oct. %	Mar. %	Oct. %	Mar. %
Mean.	71.64	91.24	73.36	92.91	46.15	78.56	50.61	80.38
Improvement.	19.60		19.55		32.41		29.77	
Room W.								
Mean.	78.84	89.10	89.51	90.48	54.94	74.05	61.64	78.46
Improvement.	10.26		.97		19.11		16.82	
Room J.								
Mean.	86.67	92.63	85.89	95.78	64.11	86.63	81.11	90.73
Improvement.	5.96		9.89		22.52		9.62	
Room H.								
Mean.	86.05	91.46	81.60	88.53	59.33	81.00	69.51	87.66
Improvement.	5.41		6.93		21.67		18.15	
Room R.								
Mean.	86.94	92.33	87.78	90.94	70.10	87.88	76.54	87.78
Improvement.	5.39		3.16		17.78		11.24	
Entire Group.								
Mean.	82.59	91.33	83.56	83.19	57.71	81.55	66.46	85.03
Improvement.	8.74		(Loss).37		23.84		18.57	

Table LXII. Showing the Improvement in Mean Scores, expressed in percent, for all Rooms in each process from the Initial to the Re-test.

	A. P.		S. P.		M. P.		L. D. P.	
Room L.	Oct. %	Mar. %	Oct. %	Mar. %	Oct. %	Mar. %	Oct. %	Mar. %
Mean.	71.64	91.24	73.56	92.91	46.15	78.56	50.61	80.58
Improvement.	19.60		19.55		32.41		29.77	
Room W.								
Mean.	78.84	89.10	89.51	90.46	54.94	74.05	61.64	78.46
Improvement.	10.26		.97		19.11		16.82	
Room T.								
Mean.	86.67	92.65	85.89	95.78	64.11	86.65	81.11	90.73
Improvement.	5.98		9.89		22.52		9.62	
Room K.								
Mean.	86.05	91.46	81.60	88.53	59.23	81.00	69.51	87.66
Improvement.	5.41		8.93		21.67		18.15	
Room R.								
Mean.	86.94	92.55	87.78	90.94	70.10	87.88	76.54	87.78
Improvement.	5.59		3.16		17.78		11.24	
Entire Group.								
Mean.	82.59	91.33	83.66	86.19	57.71	81.55	66.46	85.03
Improvement.	8.74		(loss).57		23.84		18.57	

4. DECREASE IN MEAN TIME IN ALL ROOMS IN EACH PROCESS.

Since very little has been said about time in this study, perhaps just a few words here might be pertinent. As noted in the Instruction Sheet at the beginning, time was not to be stressed during the giving of the tests. However in the corrective work in the classroom this stipulation was not binding. Time is an important element in all drill and the decrease in time is an indication of better habits of work. In the experimental group accuracy was stressed and time came along as a by-product. As pupils improved in automatic response, time was saved. As process step difficulties were corrected, and process steps were correctly re-learned time was saved in working out examples. So time was treated as an incidental rather than an important part of this work.

Since there was a time standard set up after the giving of the first tests, but not stressed even in the Re-Test, the pupils had no idea how long they should have taken to do each test. No emphasis was put on the time standards even in talking with the cooperating teachers, so the results in time are derived as a natural thing in the regular course of events.

The time standards were set by the writer, who in turn based them on the estimates given by Dr. Wilson on the reverse of some copies of his tests. Two of them were placed at the half way point between the acceptable standard and the

better one. To be more specific, in addition for grade 6 the standard is 6 to 12 minutes, better if only 5, so the writer chose 8 for the group. This choice is shown in the following manner:

	STANDARDS OF DR. WILSON FOR GR. 6.	STANDARDS CHOSEN FOR THIS STUDY.
Addition	12 to 5 minutes	8 minutes
Subtraction	12 to 5 minutes	8 minutes
Multiplication	12 to 6 minutes	12 minutes
Long Division	30 to 20 minutes	20 minutes

Table LXIII shows the decrease in the mean time expressed in minutes for all the rooms in each process on the Initial and the Re-test. The greatest decrease in time was in long division, one class taking 9.63 minutes less to do the test and another class taking 7.97 minutes less. Multiplication comes second with one class taking nearly 4 minutes less to do the test in Mar. than in Oct.

better one. To be more specific, in addition for grade 6 the standard is 6 to 12 minutes, better if only 6, so the writer chose 6 for the group. This choice is shown in the following manner:

	STANDARDS OF DR. WILSON FOR GR. 6.	STANDARDS CHOSEN FOR THIS STUDY.
Addition	12 to 6 minutes	8 minutes
Subtraction	12 to 6 minutes	8 minutes
Multiplication	18 to 6 minutes	12 minutes
Long Division	30 to 20 minutes	20 minutes

Table LXIII shows the decrease in the mean time expressed in minutes for all the rooms in each process on the Initial and the Re-test. The greatest decrease in time was in long division, one class taking 9.55 minutes less to do the test and another class taking 7.97 minutes less. Multiplication comes second with one class taking nearly 4 minutes less to do the test in Mar. than in Oct.

Table LXIII. Showing Decrease in Mean Time expressed in minutes for all Rooms in each process on both the Initial and the Re-test.

	A. P.		S. P.		M. P.		L. D. P.	
Room L.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.
	Minutes.		Minutes.		Minutes.		Minutes.	
Mean.	10.51	11.97	8.44	7.65	16.21	12.80	30.88	22.64
Decrease(Gain)	1.46		.79		3.41		8.24	
Room W.								
Mean.	9.76	8.49	8.05	6.78	14.92	12.13	28.15	23.82
Decrease.	1.29		1.27		2.79		4.33	
Room J.								
Mean.	9.30	9.23	7.44	6.48	11.36	10.92	16.66	16.24
Decrease.	.07		.96		.44		.42	
Room H.								
Mean.	13.75	10.06	7.94	7.03	14.86	11.06	29.88	20.25
Decrease.	3.69		.91		3.80		9.63	
Room R.								
Mean.	9.71	9.50	7.88	6.47	12.26	9.51	25.54	17.57
Decrease.	.21		1.41		2.75		7.97	
Entire Group. Mean.	10.34	9.82	7.81	6.87	13.73	11.27	26.36	22.77
Decrease.	.52		.94		2.46		3.60	

Table LXIII. Showing Decrease in Mean Time expressed in minutes for all Rooms in each process on both the Initial and the Re-test.

	A. P.		S. P.		M. P.		L. D. P.	
Room L.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.
	Minutes.		Minutes.		Minutes.		Minutes.	
Mean.	10.51	11.37	8.44	7.68	16.21	12.80	30.88	22.64
Decrease(Gain)	1.46		.76		3.41		8.24	
Room W.								
Mean.	9.76	8.49	8.08	6.78	14.92	12.13	28.15	23.33
Decrease.	1.29		1.27		2.79		4.82	
Room J.								
Mean.	8.50	8.25	7.44	6.48	11.58	10.92	16.66	16.24
Decrease.	.07		.96		.44		.42	
Room H.								
Mean.	13.75	10.06	7.94	7.03	14.86	11.06	29.88	20.28
Decrease.	3.69		.91		3.80		9.60	
Room B.								
Mean.	9.71	8.80	7.86	6.47	12.26	9.31	25.54	17.97
Decrease.	.91		1.41		2.76		7.57	
Entire Group.								
Mean.	10.34	9.82	7.81	6.67	13.73	11.27	26.56	22.77
Decrease.	.52		.94		2.46		3.60	

5. IMPROVEMENT OF MEAN SCORES AND DECREASE OF MEAN TIME BETWEEN INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.

Table LXIV. shows a comparison of the gain in mean scores and the decrease in mean time existing between the Initial and the Re-test by rooms for each process.

This table shows that a steady decrease in time has been made throughout all the processes with one exception in Room L which took 1.46 minutes longer to do the Re-test than it did to do the Initial Test. There was one exception in score too, and that was in Room H on the S. P. Re-test caused by a very large absence on the day of the test. This absence made the mean score for the entire group .37% less than it was in Oct.

Table LXV. shows the improvement of mean scores and the decrease of mean time between the Initial and the Re-test by rooms for each process.

Table LXIV. Showing Comparison of Improvement in Mean Scores and Decrease in Mean Time on the Initial and Re-tests by Rooms for each process.

	A. P.	S. P.	M. P.	L. D. P.
	Room L. - 39 Pupils.			
Mean Score %				
Initial.	71.64	73.36	46.15	50.61
Re-test.	91.24	92.91	78.56	80.38
Gain.	19.60	19.55	32.41	29.77
Mean Time in Minutes.				
Initial.	10.51	8.44	16.21	30.88
Re-test.	11.97	7.65	12.80	22.64
Decrease	(Loss) 1.46	.79	3.41	8.24
	Room W. - 38 Pupils.			
Mean Score %				
Initial.	78.84	89.51	54.94	61.64
Re-test.	89.10	90.48	74.05	78.46
Gain.	10.26	.97	19.11	16.82
Mean Time in Minutes.				
Initial.	9.76	8.05	14.92	28.15
Re-test.	8.49	6.78	12.13	23.82
Decrease	1.27	1.27	2.79	4.33
	Room J. - 36 Pupils.			
Mean Score %				
Initial.	86.67	85.89	64.11	81.11
Re-test.	92.63	95.78	86.63	90.73
Gain.	5.96	9.89	22.52	9.62
Mean Time in Minutes.				
Initial.	9.30	7.44	11.36	16.66
Re-test.	9.23	6.48	10.92	16.24
Decrease	.07	.96	.44	.42

Table LXIV. Showing Comparison of Improvement in Mean Scores and Decrease in Mean Time on the Initial and Re-tests by Rooms for each process.

	A. P.	S. P.	M. P.	L. D. P.
Room L. - 39 Pupils.				
Mean Score %				
Initial.	71.64	73.86	46.15	50.61
Re-test.	91.24	92.91	78.56	80.38
Gain.	19.60	19.05	32.41	29.77
Mean Time in Minutes.				
Initial.	10.51	8.44	16.21	20.86
Re-test.	11.97	7.65	12.80	22.64
Decrease (Loss)	1.46	.79	3.41	8.24
Room W. - 38 Pupils.				
Mean Score %				
Initial.	73.84	89.61	64.04	61.64
Re-test.	89.10	90.48	74.08	78.46
Gain.	10.26	.87	19.11	16.82
Mean Time in Minutes.				
Initial.	9.76	8.06	14.92	28.15
Re-test.	8.49	6.78	12.15	25.82
Decrease	1.27	1.27	2.79	4.33
Room J. - 36 Pupils.				
Mean Score %				
Initial.	86.87	86.89	64.11	81.11
Re-test.	93.63	95.76	86.53	90.73
Gain.	6.76	9.89	22.52	9.62
Mean Time in Minutes.				
Initial.	9.30	7.44	11.36	16.66
Re-test.	9.23	6.48	10.92	16.24
Decrease	.07	.96	.44	.12

Table LXIV. (Cont.)

Mean Score-%.	Room H. - 30 Pupils.			
Mean Score %				
Initial.	86.05	81.60	59.33	69.51
Re-test.	91.46	88.53	81.00	87.66
Gain.	5.41	6.93	21.67	18.15
Mean Time in Minutes.				
Initial.	13.75	7.94	14.86	29.88
Re-test.	10.06	7.03	11.06	20.25
Decrease	3.69	.91	3.80	9.63
Mean Score-%.	Room R. - 38 Pupils.			
Mean Score %				
Initial.	86.94	87.78	70.10	67.54
Re-test.	92.33	90.94	87.88	87.78
Gain.	5.39	3.16	17.78	11.24
Mean Time in Minutes.				
Initial.	9.71	7.88	12.26	25.54
Re-test.	9.50	6.47	9.51	17.57
Decrease	.21	1.41	2.75	7.97

Table LXIV. (Cont.)

Room E. - 30 Pupils.

Mean Score	80.05	81.60	89.33	69.81
Initial.	81.16	83.89	81.00	87.69
Re-test.	5.41	6.35	81.07	10.15
Gain.				
Mean Time in				
Minutes.		7.91	14.86	29.80
Initial.	19.75	7.05	11.08	20.35
Re-test.	10.06	.71	3.80	9.65
Decrease	3.69			

Room K. - 28 Pupils.

Mean Score	86.54	87.76	70.10	67.54
Initial.	92.33	90.34	87.88	87.78
Re-test.	5.80	3.10	17.78	11.24
Gain.				
Mean Time in				
Minutes.	5.71	7.68	12.56	25.54
Initial.	9.30	5.47	9.61	17.57
Re-test.	.71	1.41	2.76	7.97
Decrease				

Table LXV. Showing a comparison of Gain in Mean Scores and the Decrease in Mean Time existing between the Initial and the Re-test by Rooms for each process.

	A. P.		S. P.		M. P.		L. D. P.	
Room.	Score. %	Time. Min.	Score. %	Time. Min.	Score. %	Time. Min.	Score. %	Time. Min.
L.	19.60	1.46	19.55	.79	32.41	3.41	29.77	8.24
W.	10.26	1.27	.97	1.27	19.11	2.79	16.82	4.33
J.	5.96	.07	9.89	.96	22.52	.44	9.62	.42
H.	5.41	3.69	6.93	.91	21.67	3.80	18.15	9.63
R.	5.39	.21	3.16	1.41	17.78	2.75	11.24	7.97
Entire Group.	8.74	.52	(-.37)	.94	23.84	2.46	18.57	3.60

Table LXV. Showing a comparison of Gain in Mean Scores and the Decrease in Mean Time existing between the Initial and the Re-test by Rooms for each process.

Room.	A. P. Score. %	A. P. Time. Min.	B. P. Score. %	B. P. Time. Min.	M. P. Score. %	M. P. Time. Min.	L. D. P. Score. %	L. D. P. Time. Min.
E.	19.60	1.46	19.65	.79	32.41	3.41	29.77	8.24
W.	10.26	1.27	.97	1.27	19.11	2.79	16.32	4.33
I.	8.96	.07	8.89	.96	22.52	.44	9.82	.42
H.	5.41	3.59	6.93	.91	21.67	5.80	18.15	9.65
R.	8.39	.21	3.16	1.41	17.78	2.75	11.24	7.97
Entire Group.	8.74	.52	(-.37)	.94	23.84	2.46	18.67	3.60

6. RESULTS OF THE EXPERIMENTAL GROUP, ROOM R, ON INITIAL AND RE-TEST IN EACH PROCESS.

Since the Experimental Group was the one with which the writer was more familiar, and since this group has received the instruction gained in the special study of Corrective Arithmetic at the college level by the writer, it would be interesting to compare the results of this group and show the gains in mean score and mean time, and the gain in the number of pupils up to both standards on both the tests. This material is brought together on Table LXVII. The largest gain in percent was in multiplication, with the second largest in long division. The largest decrease in time was in long division, nearly 8 minutes being gained, and the smallest decrease in time was in addition. The largest gain in pupils up to both standards was in long division, with addition coming a close second, and subtraction and multiplication bringing up the rear.

These gains are the outcome of a systematic plan of study, carried on regularly week in and week out, with variety in drill, attention to process step difficulties in each process, and the definite consciousness that each day's work is possible of achievement by every pupil, and that it is fun when one knows how. Constant checking of work has helped also.

Table LXVI. Showing Results of the Experimental Group, in Initial and Re-test, including Mean Scores and Mean Time, and the number of pupils up to both accuracy and time standards. In the lower half of the table Gains are shown.

Room R.	INITIAL.			RE-TEST.		
Process.	Mean Score. %	Mean Time. minutes	Pupils Up To Both Standards.	Mean Score. %	Mean Time. minutes	Pupils up To Both Standards.
A. P.	86.94	9.71	2 or 5.30%	92.33	9.50	7 or 19.46%
S. P.	87.78	7.88	6 or 16.68%	90.94	6.47	10 or 29.40%
M. P.	70.10	12.26	0 or 0%	87.88	9.51	3 or 9.09%
L. D. P.	67.54	25.54	2 or 5.12%	87.78	17.57	7 or 19.95%

Process.	Gains In % Between Mean Scores.	Decrease In Min. Between Mean Time.	Gain In Number Of Pupils Up To Both Standards.
A. P.	5.39	.21	5 or 14.16%
S. P.	3.16	1.41	4 or 12.73%
M. P.	17.78	2.75	3 or 9.09%
L. D. P.	20.24	7.97	5 or 14.83%

7. COMPARISON OF SPREAD OF SCORES IN INITIAL AND RE-TEST BY ROOMS FOR EACH PROCESS.

Since all the progress made in this study is not measured by the number of perfect scores, nor by the gains in mean score and mean time, the following tables LXVII, LXVIII, LXIX AND LXX, were made to show how the spread of scores improved from the Initial and the Re-test. They are also less technical for the lay teacher to understand, and they show the results in a very readable form. The table should be read this way. In Room L on the Initial Test there was a range in score from 100% to 32%, while on the Re-test there was a range from 100% to 56%. The tendency is for the scores to bunch together in the upper percent brackets on the Re-test and not to spread out so much with as many low percents as in the Initial Test. This same thing is true for all rooms in each process. This tendency toward higher percents shows progress, but the goal has not yet been reached of perfect scores for all the class.

Table LXVII Showing comparison of Scores obtained by pupils of Rooms L, W, J, H, R on Initial A. P. Test in October and on Re-test in March.

SCORES in %	Room L		Room W		Room J		Room H		Room R		Totals		
	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Gain
100	1	8	4	6	3	14	7	6	5	12	20	46	26
96	2	7	4	2	5	8	3	8	7	8	21	33	12
92	2	7	1	14	9	4	6	7	8	5	26	37	11
88	4	12	8	6	4	4	4	2	2	2	22	26	4
84	2	1	3	5	3	3	5	3	3	3	16	15	
80	3		4	2	2	2	4	1	3	4	16	9	
76	7		5	2	3	1	4	2	3	1	22	6	
72	2		3		2	2	1	1	6	1	14	4	
68	4		1	2			1		1		7	2	
64	3	1	1				1				5	1	
60	3		1		1						5		
56	1	1	1		1						3	1	
52	1		1								2		
48	2		1				1				4		
44													
40	1										1		
36													
32	1										1		
28													
	39	37	38	39	33	38	37	30	38	36	185	180	

		Initial	Re-test		Initial	Re-test
Median	Score	84%	92%	Time	10 Min.	9 Min.
Mean	Score	82.59%	91.33%	Time	10.34 "	9.82 "

Note upward movement of scores in March, tending to bunch above 88%. Note also gains made in high percent brackets.

Table LXVII Showing comparison of Scores obtained by Pupils of Rooms L, W, J, B, H on Initial A. T. Test in October and on Re-test in March.

SCORES	Room L		Room W		Room J		Room B		Room T		Totals	
In %	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.
100	1		4		3		1				5	
96			1								1	
92												
88												
84												
80												
76												
72												
68												
64												
60												
56												
52												
48												
44												
40												
36												
32												
28												

	Initial	Re-test	Initial	Re-test
Median	Score 84%	92%	Time 10 Min.	9 Min.
Mean	Score 82.89%	91.38%	Time 10.34"	9.82 "

Note upward movement of scores in March, tending to group above 88%. Note also gains made in High percent brackets.

Table LXVIII Showing comparison of Scores obtained by pupils of Rooms L, W, J, H, R on Initial S. P. Test in October and on Re-test in March.

SCORES in %	Room L		Room W		Room J		Room H		Room R		Totals		
	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Gain
100	3	14	5	9	3	22	3	10	6	10	20	65	45
96	3	7	10	5	6	5	7	10	9	7	35	34	
92	4	4	11	10	4	4	8	1	4	6	30	25	
88	4	4	3	3	7	3	4	3	5	4	23	17	
84	3	3	3	2	5		2		2	2	15	7	
80	2	2	2	4	3	1		2	4	1	11	10	
76	3			2	3	2	2		2	1	10	5	
72	1		1	2	2		2	1			6	3	
68	5		1		2		1			2	9	2	
64	2				1			1	2		5	1	
60	1		1				1		2		5		
56	1		1							1	2	1	
52	1						2				3		
48		1					2				2	1	
44													
40	1										1		
36	1							1			1	1	
32													
28	1										1		
24													
20													
16	1										1		
12	1										1		
8								1				1	
4							1				1		
0													
	38	35	37	37	36	37	35	30	36	34	182	173	

		Initial	Re-test		Initial	Re-test
Median	Score	88%	96%	Time	7 Min.	6 Min.
Mean	Score	83.56%	83.19%	Time	7.81 "	6.87 "

Note upward movement of scores in March, tending to bunch in the high per cent brackets.

Table LXVIII Showing comparison of Scores obtained by pupils of Rooms L, W, J, H, R on Initial S. P. Test in October and on Re-test in March.

SCORES in %	Room L Oct.	Room L Mar.	Room W Oct.	Room W Mar.	Room J Oct.	Room J Mar.	Room H Oct.	Room H Mar.	Room R Oct.	Room R Mar.	Totals Oct.	Totals Mar.	Gain
100	3	14	5	9	3	22	3	10	6	10	20	65	45
96	3	7	10	5	6	5	7	10	9	7	35	34	
92	4	4	11	10	4	4	8	1	4	6	30	25	
88	4	4	3	3	7	3	4	3	5	4	23	17	
84	3	3	3	2	5		2		2	2	15	7	
80	2	2	2	4	3	1		2	4	1	11	10	
76	3			2	3	2	2		2	1	10	5	
72	1		1	3	2		2	1			6	3	
68	5		1		2		1			2	9	2	
64	2				1			1	2		5	1	
60	1		1				1		2		5		
56	1		1							1	2	1	
52	1						2				3		
48		1					2				2	1	
44													
40	1										1		
36	1							1			1	1	
32													
28	1										1		
24													
20													
16	1										1		
12	1										1		
8								1				1	
4							1				1		
0													
	38	35	37	37	36	37	35	30	36	34	182	173	

		Initial	Re-test		Initial	Re-test
Median	Score	88%	96%	Time	7 Min.	6 Min.
Mean	Score	83.56%	83.19%	Time	7.81 "	6.87 "

Note upward movement of scores in March, tending to bunch in the high per cent brackets.

Table LXIX Showing comparison of Scores obtained by pupils of Rooms L, W, J, H, R on Initial M. P. Test in October and on Re-test in March.

SCORES in %	Room L		Room W		Room J		Room H		Room R		Totals		
	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Gain
100		1		1		6		1		3		12	12
96		1				4	1	2		11	1	18	17
92	1	3	1	2	1	7		5	4	5	7	22	15
88		5	2	5	1	5		6	2	4	5	25	20
84		5	1	5	1	5	1	4	5	1	8	20	12
80		5	2	3	3	4	3	5	3	5	11	22	11
76	3	6	1	3	7	3	6	2	2	1	19	15	
72	2	4	3	5	4	1	1	3	4		14	13	
68	3	3	2	4	4		3	2	4		16	9	
64	2		2	4	1	1	3		4	1	12	6	
60	1	1	2	1	4	2	5	1	3		15	5	
56	2		4	2	3				2	1	11	3	
52	2		1		1		1		2	1	7	1	
48	7	1	4		2		4				17	1	
44	3		6				3		1		13		
40	1	1	1				1				3	1	
36	2		2	1	1				1		6	1	
32	1			1							1	1	
28	2		1		1		1				5		
24					1		2				3		
20	1										1		
16	1		1						1		3		
12	2							1			2	1	
8			1								1		
4			1		1						2		
0	3						1				4		
	39	36	38	37	36	38	36	32	38	33	187	176	

		Initial	Re-test		Initial	Re-test
Median	Score	60%	84%	Time	13 Min.	10 Min.
Mean	Score	57.71%	81.55%	Time	13.73 "	11.27 "

Note upeard movement of scores in March, tending to bunch above 80%. Note also gains in high per cent brackets.

Table LXIX Showing comparison of Scores obtained by pupils of Rooms L, W, J, R, H on Initial & Re-test in October and on Re-test in March.

SCORES	Room L		Room W		Room J		Room R		Room H		Totals	
In %	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.
100		1		1		6		1		5		13
96		1				4	1	3		12	1	16
92	1	3	1	3	1	7		5	4	5	7	17
88		5		3	1	6		6	2	4	5	18
84		5	1	3	1	6	1	4	5	1	8	20
80		5	2	3	3	4		3	3	6	11	22
76	3	5	1	3	4	7		3	2	1	10	19
72	2	4	3	3	4	3	1	3	4		14	13
68	3	3	2	4	4			3	4		16	10
64	2		3	4	1	2			4	1	12	5
60	1	1	3	1	4		1		3		12	2
56	2		4		3				2	1	11	1
52	2		1		1		1		2	1	7	1
48	2	1	4		2		1				10	1
44	3		6				1		1		11	
40	1	1	1				1				3	1
36	2		2	1	1				1		6	1
32	1			1							1	1
28	2		1		1		1				5	
24					1		2				3	
20	1										1	
16	1		1						1		3	
12	2							1			3	1
8			1								1	
4			1		1						2	
0	3						1				4	
	39	36	38	29	36	38	36	32	38	38	187	172
			Initial		Re-test				Initial		Re-test	
Median			Score		80%		64%		Time		13 Min.	10 Min.
Mean			Score		87.72%		81.85%		Time		13.73 "	11.27 "

Note upward movement of scores in March, tending to remain above 80%. Note also gains in high per cent brackets.

Table LXX Showing comparison of Scores obtained by pupils of Rooms L, W, J, H, R on Initial L. D. P. Test in October and on Re-test in March.

SCORES	Room L		Room W		Room J		Room H		Room R		Totals		
in %	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Gain
100		3		4	3	13	1	8	2	7	6	35	29
96	1	5		3	3	3	2	10	1	6	7	27	20
92		6	5	5	3	7		3	3	4	11	25	14
88	4	6	6	4	6	7	6	6	3	8	25	31	6
84		7		7	8	1	2	2	8	4	18	21	3
80		2	4	2	3		4		6	1	17	5	
76	2		1			3	5	2	3	2	11	7	
72	2	1	1	1	3	1	2	1	2		10	4	
68	4	1	6	3	2		3	1	2		17	5	
64	4	1		2	1	1	3		1		9	4	
60	1	1	3		1	1	1		1		7	2	
56	2	1	1				1		2	1	6	2	
52					1				2	1	3	1	
48	2		2		1		2		1		8		
44	2			1							2	1	
40	1		2		1		1				5		
36	1		1	1						1	2	2	
32	1		1								2		
28	1							1	1		2	1	
24		1		1								2	
20	1										1		
16		1	1				2	1			3	2	
12	2	1	1				1		1		5	1	
8			2								2		
4	1										1		
0	4		2	1			1				7	1	
	36	37	39	35	36	37	37	35	39	35	187	179	

		Initial	Re-test		Initial	Re-test
Median	Score	76%	88%	Time	24 Min.	19 Min.
Mean	Score	66.46%	85.03%	Time	26.36 "	22.97 "

Note upward movement of scores in March, tending to bunch above 80%. Note also gains in high per cent brackets.

Table LXX Showing comparison of scores obtained by pupils of Rooms I, W, J, H, R on Initial L. D. P. Test in October and on Re-test in March.

SCORES in %	Room I Oct.	Mar.	Room W Oct.	Mar.	Room J Oct.	Mar.	Room H Oct.	Mar.	Room R Totals Oct.	Mar.
100		3		4	5	15	1	9	2	6	38	39
96	1	6		3	3	3	2	10	1	8	27	20
92		3	5	5	3	7		3	3	4	11	14
88	4	3	6	4	6	7	6	3	3	3	25	6
84		7	7	7	8	1	2	2	6	4	18	3
80		2	4	3	3	4			6	1	17	5
76	2		1			5	3	2	3	2	11	7
72	2	1	1	1	3	1	2	1	2		10	4
68	4	1	6	2	2	3		1	2		17	5
64	4	1		2	1	3			1		9	4
60	1	1	3	1	1	1			1		7	3
56	2	1	1			1			2	1	6	3
52				1					2	1	3	1
48	2		2	1		2		1			8	1
44			1								2	
40	1		2	1	1	1					5	
36	1		1	1					1		3	2
32	1		1								2	
28	1						1	1			2	1
24		1	1								1	2
20	1											
16		1	1			2	1				3	2
12	3	1	1			1		1			5	1
8			2								2	
4	1										1	
0	4		2	1		1					7	1

	Initial	Re-test		Initial	Re-test
Median	Score 76%	88%	Time	24 Min.	19 Min.
Mean	Score 68.48%	85.03%	Time	26.36 "	22.07 "

Note upward movement of scores in March, tending to bunch above 80%. Note also gains in high per cent brackets.

8. COMPARISON OF THE CORRECTIVE LOAD AT THE BEGINNING AND AT THE END OF THIS STUDY.

Still another way in which inprovement made in this study may be shown is to compare the Corrective Load at the beginning and at the end of the five months.

In Oct. in Addition 185 pupils were tested, 11 pupils or 5.94% were up to both accuracy and time standards, and 174 pupils or 94.06% formed the Corrective Load. In March 180 pupils were tested, 29 or 16.24% were up to both accuracy and time standards and 151 pupils or 83.76% formed the Corrective Load. This is a gain of 10.30% in Addition.

In Oct. in Subtraction 182 pupils were tested, 16 pupils or 8.80% were up to both accuracy and time standards, and 166 pupils or 91.20% formed the Corrective Load. In March 173 pupils were tested, 59 pupils or 34.22% were up to both accuracy and time standards and 114 pupils or 65.78% formed the Corrective Load. This is a gain of 25.42% in Subtraction.

In Oct. in Multiplication 187 pupils were tested, none had a perfect score, so 187 pupils or 100% formed the Corrective Load. In March 176 pupils were tested, 11 pupils or 6.27% were up to both accuracy and time standards and 165 pupils or 93.73% formed the Corrective Load. This is a gain

of 6.27% in Multiplication.

In Oct. in Long Division 187 pupils were tested, 5 pupils or 2.70% were up to both accuracy and time standards and 182 pupils or 97.30% formed the corrective load. In Mar. 179 pupils were tested, 31 pupils or 17.36% were up to both accuracy and time standards and 148 pupils or 82.64% formed the corrective load. This is a gain of 14.66% in Long Division. Thus in each process a lessening of the corrective load is shown. (See Table LXXI.)

Table LXXII. shows a comparison of the number of pupils that were excused from corrective work in the four fundamental processes by rooms on both the Initial and the Re-test.

Table LXXIII shows a comparison in the number of pupils up to both accuracy and time standards on the Initial and the Re-test respectively, showing gains for each process combining all rooms.

Table LXXI. Summary Table showing Percent of pupils making up Corrective Load on Initial and Re-test, and Percent of pupils being excused in each process, including the percent Gain for each process.

	INITIAL.		RE-TEST.		
Test.	% Forming Cor. Ld.	% Ex.	% Forming Cor. Ld.	% Ex.	% Gain For Each Process.
A. P.	94.06	5.94	83.76	16.24	10.30
S. P.	91.20	8.80	65.78	34.22	25.42
M. P.	100.00	0.00	93.73	6.27	6.27
L. D. P.	97.30	2.70	82.64	17.36	14.66

NOTE: These figures agree with all the tabulated results except Table LXXIV.

Table LXXII. Showing Comparison of number of pupils that were excused from corrective work in the Four Fundamental Processes by Rooms on Initial and Re-test.

	A. P.		S. P.		M. P.		L. D. P.		Totals.	
Room.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.
L.	1	4	3	11	0	1	0	2	4	18
W.	2	6	3	9	0	1	0	4	5	20
J.	2	8	3	20	0	5	3	10	8	43
H.	4	4	1	9	0	1	0	8	5	22
R.	2	7	6	10	0	3	2	7	10	27
Totals.										
	11	29	16	59	0	11	5	31	32	130
Gains.										
	18		43		11		26		98	

Table LXXII. Showing Comparison of number of pupils that were examined from compositive work in the Four Fundamental Processes by Rooms on Initial and Re-test.

Rooms.	A. P.		S. P.		M. P.		D. P.		Totals.	
	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.	Oct.	Mar.
L.	1	4	3	11	0	1	0	3	4	19
W.	2	8	3	9	0	1	0	4	5	20
J.	2	8	3	20	0	6	3	10	8	43
H.	4	4	1	9	0	1	0	8	5	22
R.	2	7	6	10	0	3	2	7	10	27
Totals.										
	11	29	16	59	0	11	5	31	32	130
Gains.										
	18		43		11		26		98	

Table LXXIII. Showing Comparison in number of pupils up to both Accuracy and Time Standards on Initial and Re-test respectively, showing Gains for each process.

Pupils Up To Both Standards.	A. P.	S. P.	M. P.	L. D. P.	Totals.
Oct.	11- 6.21%	16- 8.10%	0- 0%	5- 2.82%	32- 4.51%
Mar.	29-16.38%	59-33.33%	11- 6.21%	31-17.51%	130-18.35%
Gain.	18-10.17%	43-25.23%	11- 6.21%	26-14.68%	98-13.84%

NOTE: The above totals do not quite agree with the totals on Table LXXII because here the base 177 was used and there the base varied in each process according to the total number of pupils tested.

9. STATISTICAL SIGNIFICANCE OF DATA.

Since such a large part of this study consists of statistics, and percentage differences, before bringing it to a close it would be appropriate to determine if these differences are significant.[1] In a recent study The Holsinger formula for determining the significance of the percentage difference was used. This formula for the probable error of the percentage is:

$$P.E_{fp} = .6745 \sqrt{\frac{fp(100-fp)}{N}}$$

The formula for the probable error of the percentage difference is:

$$PE\ (dif) = \sqrt{(PE \text{ of 1st percent})^2 + (PE \text{ of 2nd percent})^2}$$

If the actual difference between the two scores is more than 5 times the probable error of the difference, the gain is significant, statistically speaking.

Are the gains made in the A. P. TEST in this study significant? Using the Mean Score on the Initial A. P. Test 82.59% and the Mean Score on the A. P. Re-Test, 91.33%, with a gain of 8.74% we have the following results:-

$$PE = .6745 \sqrt{\frac{fp(100-fp)}{N}} = .6745 \sqrt{\frac{82.59(100-82.59)}{185}} = 1.88$$

Therefore, the percentage score of 82.59 equals 82.59 $\pm$ 1.88.

The mean score on the final A. P. Test was 91.33%. Substituting into the formula we have

$$PE = .6745 \sqrt{\frac{fp(100-fp)}{N}} = .6745 \sqrt{\frac{91.33(100-91.33)}{180}} = 1.40$$

(1) Wilson, Dorothy M. "What Measures People Know and Why?" pg 82 Master's Thesis, Boston University, 1936.

5. STATISTICAL SIGNIFICANCE OF DATA.

Since much a large part of this study consists of statistics, and percentage differences, before bringing it to a close it would be appropriate to determine if these differences are significant. In a recent study (1) The Holzinger formula for determining the significance of the percentage difference was used. This formula for the probable error of the percentage is:

$$\text{P.E.}_{\text{fp}} = .6745 \sqrt{\frac{\text{fp}(100-\text{fp})}{N}}$$

The formula for the probable error of the percentage difference is:

$$\text{PE (diff)} = \sqrt{(\text{PE of 1st percent})^2 + (\text{PE of 2nd percent})^2}$$

If the actual difference between the two scores is more than 5 times the probable error of the difference, the gain is significant, statistically speaking.

Are the gains made in the A. P. TEST in this study significant? Using the Mean Score on the Initial A. P. Test 82.59% and the Mean Score on the A. P. Re-Test, 91.33%, with a gain of 8.74% we have the following results:-

$$\text{PE}_{\text{diff}} = .6745 \sqrt{\frac{\text{fp}(100-\text{fp})}{N}} = .6745 \sqrt{\frac{82.59(100-82.59)}{185}} = 1.88$$

Therefore, the percentage score of 82.59 equals 82.59 ± 1.88.

The Mean score on the Final A. P. Test was 91.33%.

Substituting into the formula we have

$$\text{PE} = .6745 \sqrt{\frac{\text{fp}(100-\text{fp})}{N}} = .6745 \sqrt{\frac{91.33(100-91.33)}{180}} = 1.40$$

(1) Wilson, Dorothy M. "What Measures People Know and Why" pg 82 Master's Thesis, Boston University, 1936.

Therefore, the percentage score of 91.33 equals 91.33 ± 1.40.

Finding the probable error of the difference we have

$$PE_{dif} = \sqrt{(PE_1)^2 + (PE_2)^2}$$

$$PE_{dif} = \sqrt{(1.88)^2 + (1.40)^2} = 2.34$$

Therefore the actual difference of 8.74 becomes 8.74 ± 2.34. Since the actual gain of 8.74 points in the mean is less than 5 times the probable error of the difference (11.70) statistically speaking the gain in score in addition is not significant.

Are the gainsmade in the M. P. TEST in this study significant? Using the Mean Score of the INITIAL M. P. TEST of 57.71% and the Mean Score of the M. P. RE-TEST of 81.55%, and the gain of 23.84% we have the following results:-

$$PE = .6745 \sqrt{\frac{fp(100-fp)}{N}} = .6745 \sqrt{\frac{57.71(100-57.71)}{187}} = 2.48$$

Therefore the percentage score becomes 57.71 ± 2.48. The mean score on the Re-Test was 91.33. Substituting into the formula we have

$$P.E = .6745 \sqrt{\frac{fp(100-fp)}{N}} = .6745 \sqrt{\frac{81.55(100-81.55)}{176}} = 1.97$$

Therefore the percentage score of 91.33 equals 91.33 ± 1.97.

Finding the probable error of the difference we have

$$PE_{dif} = \sqrt{(PE_1)^2 + (PE_2)^2} = \sqrt{(2.48^2 + (1.97)^2} = 3.16$$

Therefore the actual difference of 23.84 becomes 23.84 ± 3.16.

Therefore, the percentage score of 91.33 equals 91.33 ± 1.40.

Finding the probable error of the difference we have

$$PE_{diff} = \sqrt{(PE_1)^2 + (PE_2)^2}$$

$$PE_{diff} = \sqrt{(1.88)^2 + (1.40)^2} = 2.34$$

Therefore the actual difference of 8.74 becomes 8.74 ± 2.34.

Since the actual gain of 8.74 points in the mean is less than 5 times the probable error of the difference (11.70) scientifically speaking the gain in score in addition is not significant.

Are the gainsmade in the M. P. TEST in this study significant? Using the Mean Score of the INITIAL M. P. TEST of 87.71% and the Mean Score of the M. P. RE-TEST of 91.55%, and the gain of 23.84% we have the following results:-

$$PE = .6745 \sqrt{\frac{pq(100-pq)}{N}} = .6745 \sqrt{\frac{87.71(100-87.71)}{187}} = 2.48$$

Therefore the percentage score of 87.71 ± 2.48. The mean score on the Re-Test was 91.55. Substituting into the formula we have

$$P.E = .6745 \sqrt{\frac{pq(100-pq)}{N}} = .6745 \sqrt{\frac{91.55(100-91.55)}{176}} = 1.97$$

Therefore the percentage score of 91.55 equals 91.55 ± 1.97.

Finding the probable error of the difference we have

$$PE_{diff} = \sqrt{(PE_1)^2 + (PE_2)^2} = \sqrt{(2.48)^2 + (1.97)^2} = 3.16$$

Therefore the actual difference of 23.84 becomes 23.84 ± 3.16.

Since 5 times 3.16 is 15.80 and since the actual gain of 23.84% is more than 5 times the 3.16, therefore statistically speaking the gain in the multiplication is significant.

In the same manner it could be determined whether or not the gains are significant in the other processes. They are significant for long division but not for subtraction.

Since 5 times 3.16 is 15.80 and since the actual gain of 23.84% is more than 5 times the 3.16, therefore statistically speaking the gain in the multiplication is significant.

In the same manner it could be determined whether or not the gains are significant in the other processes. They are significant for long division but not for subtraction.

CHAPTER VII. SUMMARY AND CONCLUSIONS.

As this study comes to a close some very pertinent questions come to mind.

1. IS THERE A NEED FOR CORRECTIVE ARITHMETIC IN THIS DISTRICT AT THE SIXTH GRADE LEVEL?

This study shows that there is a very great need for a corrective arithmetic program in this district. It showed that at the beginning in October 95.68% of the pupils in grade six needed corrective work in some process in arithmetic. It also showed that multiplication needed more study than any other process, that long division came second, that addition was third and that subtraction was fourth. All percentages showing the corrective load were above 90%. (See Tables LXXI.)

2. IS SUCH A LARGE CORRECTIVE LOAD THE COMMON EXPERIENCE OF OTHER SCHOOLS AND DISTRICTS, OR IS THIS SITUATION UNIQUE IN THIS DISTRICT?

The situation found in this district can be duplicated many times over in other districts and schools; Hanley's data showed similar conditions in the Town surveyed. Nelson's study showed the same situation at the Junior High School level in another large city. Yarbrough's study showed the same conditions at the sixth grade level in the system which she surveyed.

3. WAS PROGRESS MADE BY THIS GROUP IN THE TIME SPENT IN THIS STUDY?

There was progress made in every process in mean scores, in mean time, in number of pupils attaining a perfect score, in

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2. IS SUCH A LARGE CORRECTIVE LOAD THE COMMON EXPERIENCE OF OTHER SCHOOLS AND DISTRICTS, OR IS THIS SITUATION UNIQUE IN THIS DISTRICT?

The situation found in this district can be duplicated many times over in other districts and schools; Bentley's data showed similar conditions in the Town surveyed. Nelson's study showed the same situation at the Junior High School level in another large city. Yerbrough's study showed the same conditions at the sixth grade level in the system which she surveyed.

3. WAS PROGRESS MADE BY THIS GROUP IN THE TIME SPENT IN THIS STUDY?

There was progress made in every process in mean score, in mean time. In number of pupils attaining a perfect score, in

the number of pupils reaching the time standard for each process, and in the reduction of the corrective load during the course of this study.

Table LXXIV shows the summary of all the data in this study in per cents. It shows that in addition the mean score rose from 82.59% to 91.33%; the mean time went from 10.34 minutes to 9.82 minutes, an improvement of .52 minutes; the percent of pupils up to both standards of accuracy and time went from 6.21% to 16.24%, a gain of 10.30%; and that the corrective load went down from 94.06% to 83.89%, a gain of 10.15%. The story of addition is more or less duplicated for each one of the other processes studied, as can be seen from a study of Table LXXIV.

It is interesting to note that on the initial test the mean scores were in the lower per cent brackets. On the retest three of the mean scores are in the 80% bracket and addition is in the 90% bracket. The greatest reduction in time was in the long division test, approximately 4 minutes less time being taken by the group to do the test in March than was taken in October. The process showing the greatest improvement in perfect scores was subtraction which showed a gain of 25.47%.

4. IS SUCH A STUDY VALUABLE TO THE CLASSROOM TEACHER?

Such a study is valuable to the classroom teacher because it is an unbiased statement of fact which shows conditions as they are. It shows where weaknesses lie for each pupil. It shows where the greatest need is for classes as well as for individuals. It also shows the benefit of a systematic plan of drill.

Table LXXIV. Grand Summary Table for both Initial and Re-test, showing the Summary of all Data in this study.

INITIAL	A. P.	S. P.	M. P.	L. D. P.
Mean Score.	82.59%	83.56%	57.71%	66.46%
Mean Time.	10.34 Min.	7.81 Min.	13.73 Min.	26.46 Min.
% Of Perfect Scores.	10.82%	10.98%	0.%	3.21%
% Up To Both Standards.	6.21%	8.10%	0.%	2.82%
% Of Corrective Load.	94.06%	91.20%	100.%	97.30%
RE-TEST.				
Mean Score.	91.33%	83.19%	81.55%	85.03%
Mean Time.	9.82 Min.	6.87 Min.	11.27 Min.	22.77Min.
% Of Perfect Scores.	25.76%	37.70%	6.84%	19.43%
% Up To Both Standards.	16.24%	34.22%	6.27%	17.36%
% Of Corrective Load.	83.76%	65.78%	93.73%	82.64%

5. CONCLUSION.

The writer has come to the conclusion that there is a very definite need for a corrective arithmetic program in this district today; that teachers must learn to adapt individual methods to larger groups so that each individual will benefit from the instruction given to the fullest extent possible; that well planned, well thought-out lessons with each individual need be kept as clearly as possible in mind should be the chief objective of every teacher in every grade in which this subject is taught.

It is obvious from this study that a mean class score in the eighties on an adequate test of a fundamental process leaves a very large corrective load. Other similar studies show that the mean class score must advance into the upper nineties, even above 99 to be anything like satisfactory. The need for new and higher standards for essential drill is apparent.

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APPENDIX.

Showing the Process Tests used for testing in this study.

THE WILSON INVENTORY AND DIAGNOSTIC TESTS IN ARITHMETIC

Score_____

Time_____

Test A P Addition Process Step Difficulties

(Form 2. Cooperation of Edward Soles, Gertrude Hanley, and Dorothy Yarbrough)

MAR 16 1939

Name_____ Age_____ Grade_____ Building_____ City_____

To the Pupil: Add throughout this test.
If you hesitate, place a check (✓).
If you count, double check (✓✓).
Note time when you start_____: when you stop_____

Directions for Scoring:
Each set counts for four points. The total score is 100.
All parts of (a) must be correct to merit the five points.

(a)	(b)	(c)	(d)
6 8 7 3 9 4 8 5 7 9 8 9 5 9 7 8 0 8 0 6	4 3 2 6 3	2 6 4 2 4	2 5 6 0 3

(e)	(f)	(g)	(h)	(i)	(j)	(k)
2 0 7 1 0 5 3	1 0 3 3 5 6 1 0	2 1 3 2 2 3 1 3	1 3 3 1 1 2 2 1 1 2	5 0 7 4 0 7 0 1	1 3 3 5 2 0 3 0 0	2 0 4 8 1 3 1 4 0 0

(l)	(m)	(n)	(o)	(p)	(q)	(r)
3 5 4 7 3 4 6 8	5 6 2 2 7 3 9 4	1 4 2 9 7 6 8	3 6 7 2 9 8 1 9 8	7 8 6 4 9 7 9 7 8	7 6 9 8 7 3 4 6 7 4	6 0 7 8 8 4 5 5 8 5

(s)	(t)	(u)	(v)	(w)	(x)	(y)
7 8 9 6 8 7 0 4 6	$1.2 0 .5 4 6.6 5 9.5 0 2.1 7	$3.7 9 8.9 4 3.4 8 .8 6 3.9 5	$5 6.5 4 4 9.5 3 4 4.8 6 6 4.0 2 8 1.3 2 4 4.0 5	$ .1 7 5.3 7 2.3 7 6.7 5 4.8 6	$7 6.4 5 8 1.8 7 5 8.4 6 5 6.5 8 4 6.7 9 3 7.4 9 8 8.0 0	$ .5 5 5.3 9 4.8 7 2.0 9 9.7 5

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THE WILSON INVENTORY AND DIAGNOSTIC TESTS
IN ARITHMETIC

Test S P Subtraction Process Step Difficulties

MAR 15 1939

Name_____ Age_____ Grade_____ Building_____ City_____

To the Pupil: Subtract in this test.

If you hesitate, place a check (✓).
If you count, double check (✓✓).

Note time when you start_____: when you stop_____

(a)

8	7	9	5	8	7	9	7	6	9
7	0	3	0	5	4	6	7	0	8

(b)

10	14	17	10	13	15	12	11	13
6	5	8	4	5	7	3	2	7

(c)

67	837	37	864	58	98	425
51	426	22	632	31	58	325

(d)

84	736	92	1322	1133
34	336	62	997	766

(e)

1189
453

(f)

7558
3009

(g)

4282
120

(h)

715
236

(i)

6003
1400

(j)

4544
916

(k)

829
57

(l)

9261
4780

(m)

5341
2186

(n)

1400
1254

(o)

4700
1432

(p)

7849
1991

(q)

15098
8020

(r)

1491
843

(s)

1302
804

(t)

1276
897

(u)

$5.00
1.51

(v)

$55.40
42.25

(w)

$8.10
5.98

(x)

$25.10
17.05

(y)

$14.00
9.98

The score is the number right times 4. Score_____

Time_____

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THE WILSON INVENTORY AND DIAGNOSTIC TESTS
IN ARITHMETIC

Test M P Multiplication Process Step Difficulties

Name_____ Age_____ Grade_____ Building_____ City_____ MAR 14 1939

To the Pupil: In this test, multiply.

If you hesitate, place a check (✓).
If you count or say the tables, double check (✓✓).

Note time when you start_____: when you finish_____

(a) 8 7 4 2 6 7 3 2 8 6 / 6 3 9 7 4 5 3 3 4 7	(b) $3.65 × 6	(c) 501 × 6	(d) $8.05 × 7		
(e) 6 4 7 4 1 3 9 0 8 1 / 0 5 8 4 1 4 2 3 9 8	(f) $7.40 × 6	(g) $5.90 × 10	(h) $700.95 × 4		
(i) 71 × 17	(j) 362 × 21	(k) 93 × 47	(l) 92 × 56	(m) 93 × 89	(n) $7.30 × 29
(o) 896 × 83	(p) 693 × 600	(q) 445 × 308	(r) 154 × 270	(s) 7081 × 509	(t) $680. × 120
(u) 915 × 504	(v) 506 × 159	(w) 8302 × 805	(x) 1784 × 367	(y) 842 × 2100	

The score is the number right times 4. Score_____

Time_____

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THE WILSON INVENTORY AND DIAGNOSTIC TESTS
IN ARITHMETIC

Test L D P Long Division Process Step Difficulties

MAR 13 1939

Name_____ Age_____ Grade_____ Building_____ City_____

To the Pupil: This is a test in long division.
If at any point you do not know what to do, place a check (✓) and try to note the reason. When the test is over, get your teacher to help you on the points that bothered.

Note time when you start_____ ; when you finish_____

Divide:

30)$ 6.90 (a)	32)3872 (b)	51)5693 (c)	21)6749 (d)	52)1198 (e)
28)392 (f)	61)1974 (g)	45)$ 31.50 (h)	91)3915 (i)	42)1008 (j)
63)2394 (k)	59)1357 (l)	111)8991 (m)	131)2751 (n)	74)2740 (o)
14)$ 8.40 (p)	47)4300 (q)	83)76360 (r)	70)1740 (s)	98)9016 (t)
73)3358 (u)	1122)135762 (v)	32)$177.00 (w)	26)18460 (x)	45)3555 (y)

The score is the number right times 4.

Score_____
Time_____

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